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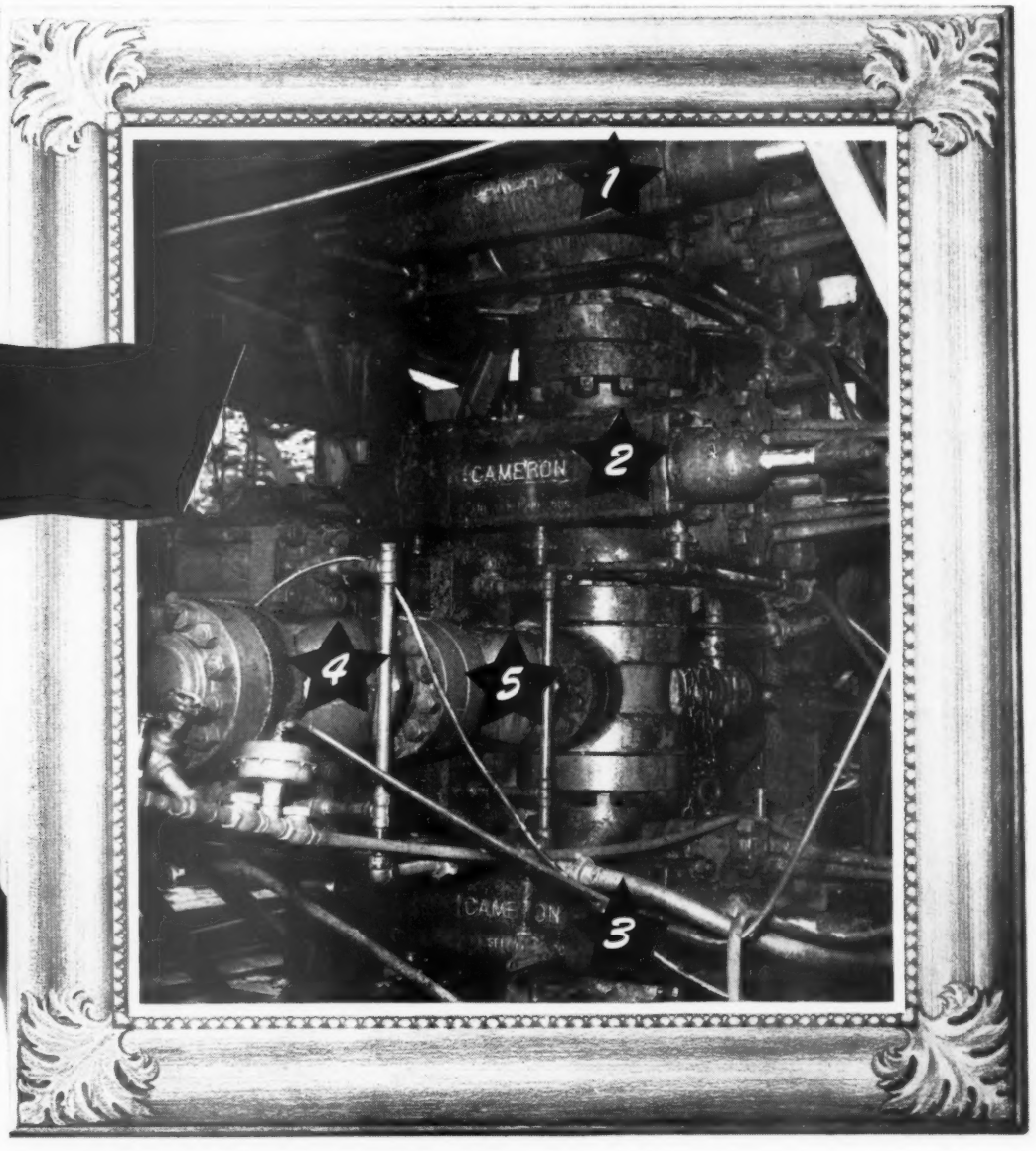

While Cameron pressure-operated drilling control units may be assembled in several safe and convenient hook-ups, the assembly presented above—installed on a deep test in South Louisiana—is probably the most popular combination of control units. It consists of (1) and (2) 10-inch Series 1500, QRC Blowout Preventers equipped with pipe rams; (3) 10-inch Series 1500, QRC Blowout Preventer equipped with blind rams for closing the well bore with pipe out of the hole; (4) and (5) 6-inch Series 1500, HCR Gate Valves to provide a double safeguard against loss of control through the flow lines.

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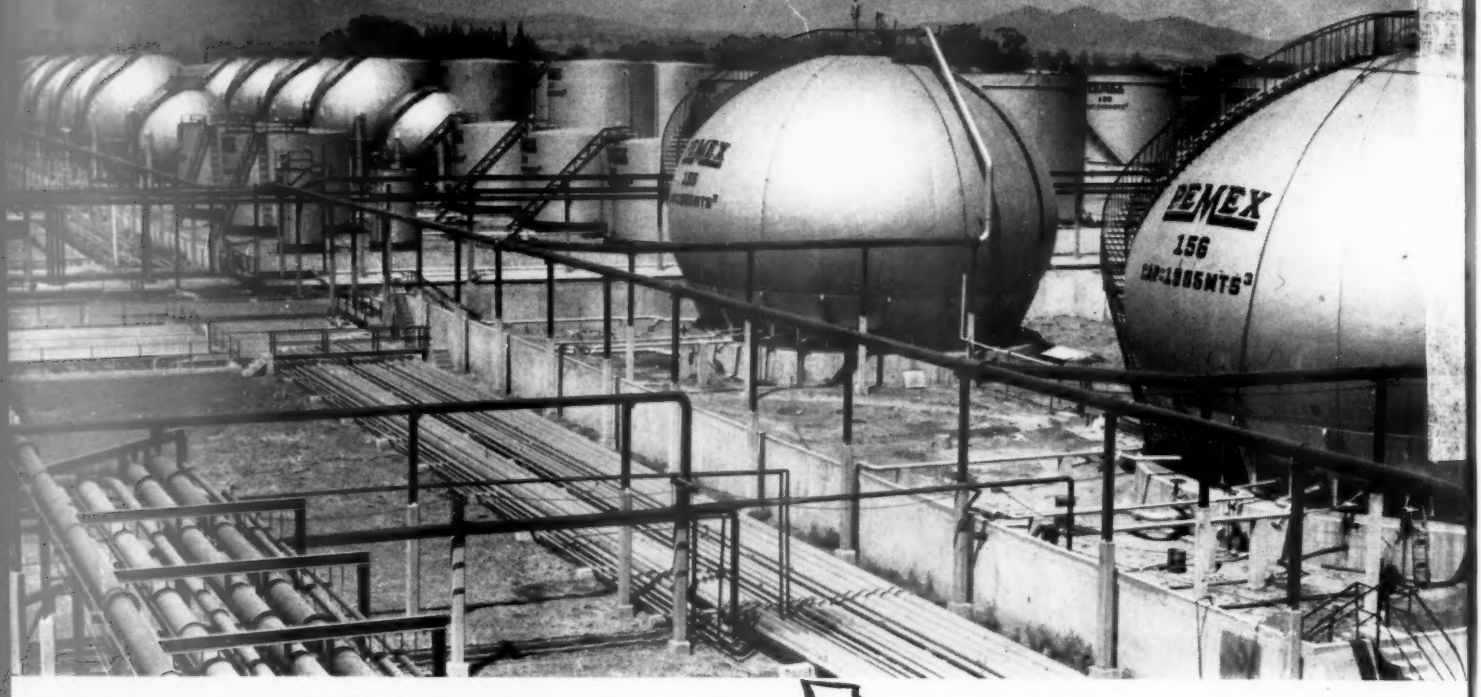

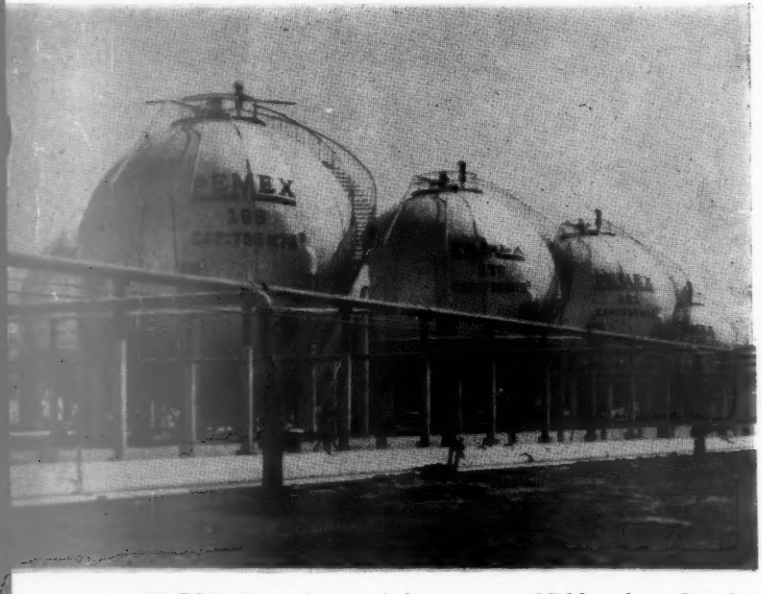

AT TOP: General view of the numerous CB&I tanks at Petroleos Mexicanos' Atzcapotzalco refinery, showing two of the four Hortonspheroids and ten of the Hortonspheres. DIRECTLY ABOVE: Close-up view of some of the Hortonspheres at the Atzcapotzalco refinery.

South of the Border

Petroleos Mexicanos offers a striking example of the way in which modern storage facilities are employed to combat evaporation losses down Mexico way. Numerous Chicago Bridge storage tanks and steel plate work structures are installed at both the Atzcapotzalco refinery and the Poza Rica topping plant of "PEMEX." There are 12 new Hortonspheres and four new Hortonspheroids at these two locations.

Hortonspheroids are recommended for storing motor gasolines and natural gasolines requiring pressures of 2½ lbs. per sq. in. or less. They are available in standard capacities up to 120,000 bbls.

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THE Petroleum Engineer

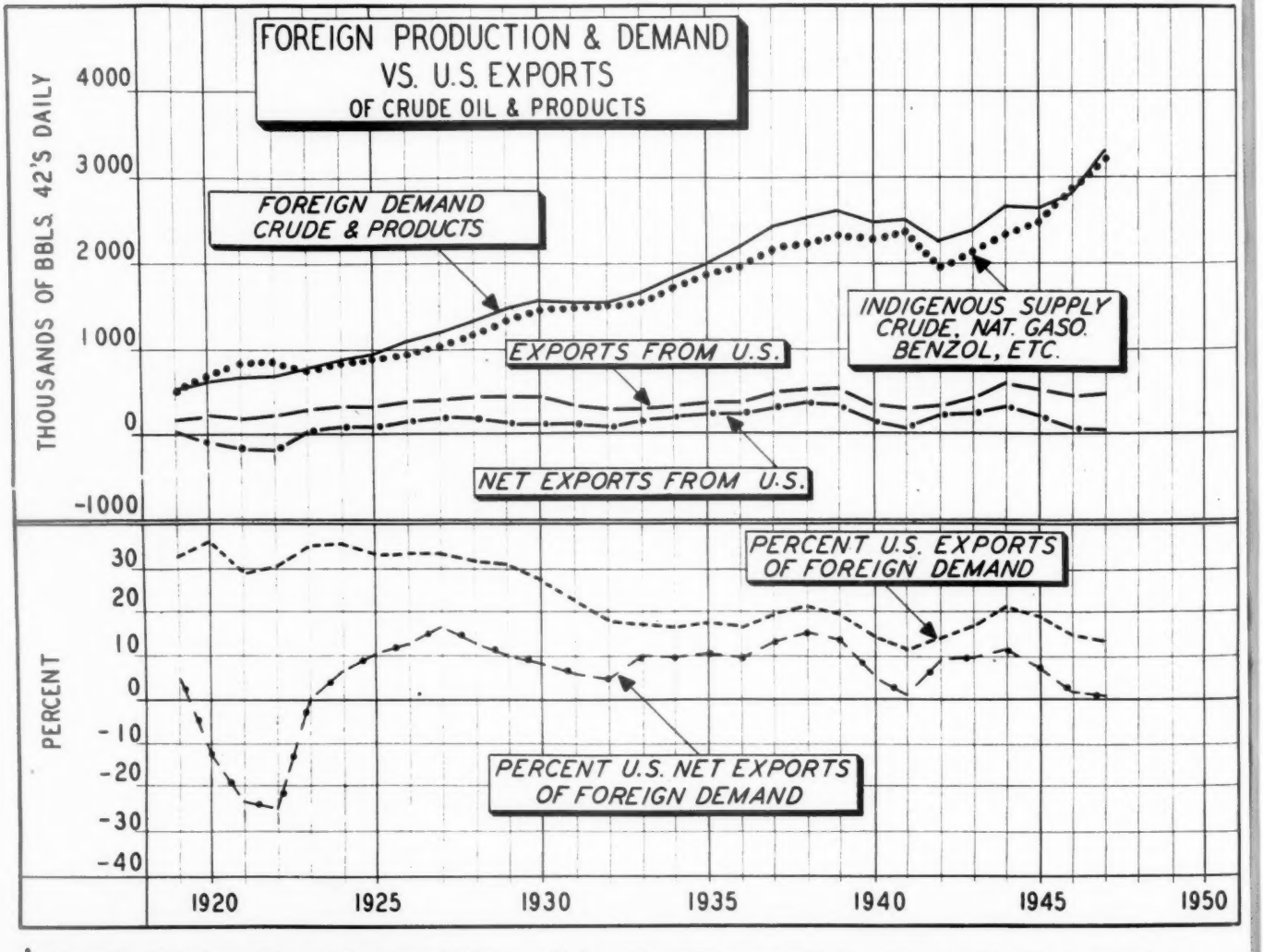
INDEX to Vol. XX
From October, 1948 to December, 1948, Inclusive

SUBJECT INDEX

TITLE OF ARTICLE AND AUTHOR	Decimal No.	No.	Mo.	Year	Page
GENERAL					
History and Analysis of Bureau of Mines' Petroleum and Natural Gas Division, Part I, Ernestine Adams	031.132	3	Dec.	1948	41
International Scholarships Improve Trade Relations	093.1	1	Oct.	1948	168
GEOGRAPHICAL					
Roundup of World Oil Activities, Ernestine Adams	100.	1	Oct.	1948	45
Petroleum Map of Wyoming	111.52	2	Nov.	1948	188
Pictorial Wyoming	111.52	2	Nov.	1948	126
Wyoming—Its Past and Its Promise, Ernestine Adams	111.52	2	Nov.	1948	37
Mexican Oil Increase due to Poza Rica Field, John J. Slattery	112.	1	Oct.	1948	158
Canada, 1948, Floyd K. Beach	113.	1	Oct.	1948	125
Interesting New Discoveries in Venezuela	122.	1	Oct.	1948	190
Paraguay Diary, C. S. Perkins	129.	1	Oct.	1948	139
Pipe Line Problems Affect Chile's Oil Development, Glen M. Ruby	129.	1	Oct.	1948	164
Third Well Drilling in the Paraguayan Chaco, Richard Sneddon	129.	1	Oct.	1948	182
Two Years in France, Edward D. Lynton	135.	1	Oct.	1948	170
Australasia	161.	1	Oct.	1948	264
PHYSICAL AND CHEMICAL PROPERTIES OF PETROLEUM					
Crude Oils of Wyoming, John S. Ball and Ralph H. Espach	210. and 220.	2	Nov.	1948	229
EXPLORATION AND PROSPECTING FOR PETROLEUM					
Geology and Petroleum Resources of Wyoming Horace D. Thomas	305.111.52	2	Nov.	1948	128
Offshore California Gets Geophysical Survey, Richard Sneddon	306.3	1	Oct.	1948	242
Above Ground Detonations Used in Seismic Exploration	368.2	3	Dec.	1948	124
DEVELOPMENT OF FIELDS					
New Try Made for Signal Hill Deep Zone, Richard Sneddon	409.	2	Nov.	1948	177
What Leduc Means to Canada, H. G. Cochrane	409.	3	Dec.	1948	128
Dry Hole Survey Lessens Water Flooding Hazards, F. R. Cozzens	410.	1	Oct.	1948	184
Drilling					
Advancement in Contract Drilling, A. J. Heiser	420.	1	Oct.	1948	222
Plastic Tubes Preserve Core Information, Wallace Sawdon	420.111.	3	Dec.	1948	139
Development of Kleiner Pool Revives Interest in Cisco, Texas, Claribel Thompson	420.13	3	Dec.	1948	157
Late Exploratory Developments in Wyoming, Irving Garbutt	420.13	2	Nov.	1948	154
Fuel Oil for Diesel Locomotives in Relation to the Supply of Petroleum	422.344.4	1	Oct.	1948	105
Large Steam Rig Service Has Deep Drilling Laboratory, K. Marshall Fagin	425.21	3	Dec.	1948	115
British Designed 150-hp 3-Drum Transportable Hoist, F. G. Bailey	425.217.	3	Dec.	1948	53
Measurement of Mud Viscosities at High Temperatures, V. N. Bednarski	425.218.411.	1	Oct.	1948	192
Recording Device for Control of Drilling Mud, F. Neurath	425.218.411.	2	Nov.	1948	182
Plastic Resins Used With Oil-Base Mud, Orie O. Dale	425.218.43	2	Nov.	1948	168
Cementing Wells					
Analysis of Present Day Oil Well Casing Cementing Practice, W. H. Griffin	444.	2	Nov.	1948	117
PRODUCTION					
The Natural Gas Industry, E. DeGolyer	502.	3	Dec.	1948	148
Oil Production					
Calculation of Pumping Unit Engine Drives, Ed Caraway	514.5	1	Oct.	1948	156
How to Select Sucker Rod Pumps, Kenneth N. Mills	514.5	3	Dec.	1948	142
Increasing Production Efficiency					
Application of Secondary Recovery in the United States as Related to Emergency Oil Requirements, Paul D. Torrey	530.	2	Nov.	1948	190
Gas Injection Into San Andres Formation Begun at Goldsmith, K. Marshall Fagin	533.2	2	Nov.	1948	141
Economics of Cycling, M. G. Arthur	537.5	1	Oct.	1948	142
Retorting of Oil Shales					
Union Develops Shale Oil Retorting Method, Homer Reed and Clyde Berg	584.31	3	Dec.	1948	214
TRANSPORTATION, STORAGE, AND GAUGING					
Wyoming Pipe Lines Meet Production Demands, Irving Garbutt	605.	2	Nov.	1948	271
Heater Box for Control Valve	683.35	1	Oct.	1948	290
Oil Transportation					
Alaska Standard Has First Major Overhaul in 24 Years	614.	1	Oct.	1948	341
Tanker Transportation, M. G. Gamble	614.	2	Nov.	1948	276
Middle East Pipe Lines, Frank H. Love	615.	1	Oct.	1948	325
Oil Pipe Line Construction Since the War, John E. Boice	615.	3	Dec.	1948	258
Oxygen Carrier Device, O. C. Irvine	615.322.	2	Nov.	1948	278
Station Modernization Program Increases Capacity and Lowers Operating Costs, Frank H. Love	615.512.	2	Nov.	1948	282
Interfacial Mixing Characteristics of Products in Products Pipe Line, Part 2, S. S. Smith and R. K. Schulze	615.6	1	Oct.	1948	330
Tapping Machine Aids in Draining Pipe Lines, A. M. Hill	615.63	2	Nov.	1948	273
Management Information on Cathodic Protection	615.635. and 629.1	3	Dec.	1948	262
Maine's First Products Line, L. R. Dickinson	615.92	3	Dec.	1948	254
Modern Pipe Line Stations—Hebert, Initial Station on Products Line, Frank H. Love	615.92	2	Nov.	1948	296
Modern Stations—New Stations in Utility Line Service	615.92	1	Oct.	1948	355
Gas Transportation					
Contract Let for Longest Gas Line	620.	3	Dec.	1948	243
Argentine 1100-Mile Pipe Line, Frank H. Love	623.	1	Oct.	1948	321
New Outlet for Largest Gas Field, Frank H. Love	623.	3	Dec.	1948	245
Ingenious Gas Line Leak Detector Proves Effective, Richard Sneddon	625.2	1	Oct.	1948	340
REFINING					
Processes					
Catalytic Reactions and Process Design Hold Attention of Chemical Engineers	720.	2	Nov.	1948	255
Hydrocarbon Absorption and Fractionation Process Design Methods, Part 17, Wayne C. Edmister	720.1	3	Dec.	1948	193
Problems Associated with Fischer-Tropsch Process Eugene Ayres, C. W. Montgomery, and Joel H. Hirsch	720.1	3	Dec.	1948	203
Hydrogen and Synthesis Gas Production, R. M. Reed and Arne Eriksen	720.4	1	Oct.	1948	278
Design and Operation of Leonard TCC Unit, George Kelso, C. C. Peavy, G. D. Myers, and A. W. Hoge	721.3	1	Oct.	1948	293
TCC Unit Catalytically Processes Sour Gas Oil, William M. Carney, Henry D. Noll, and A. Welsey Hoge	721.33	2	Nov.	1948	246
Catalytic Polymerization New McMurrey Unit, O. C. DeLoach	729.6	1	Oct.	1948	286
Design and Construction					
Self-Contained Naphtha Polyforming Correlation, W. A. Goldtrap and E. L. Jones	731.1	1	Oct.	1948	269
Texaco Plant Typical of Wyoming's Best, Arch L. Foster	731.1	2	Nov.	1948	236
Products and Manufacture					
Synthetic Glycerin Plant Goes on Stream, Arch L. Foster	751.71	1	Oct.	1948	274
Recovery of Liquids from Gas					
Convert Sligo Plant to Higher Pressure, Don Attaway	773.7	2	Nov.	1948	252
More Propane for Less Money, Z. C. Ambrose	775.1	3	Dec.	1948	220
ECONOMICS OF THE OIL AND GAS INDUSTRY					
A Critical Review of Methods Used in the Estimation of Natural Gas Reserves, Henry J. Gruy and Jack A. Crichton	904.	1	Oct.	1948	208
U. S. Companies Expand Foreign Operations, H. J. Struth	910.	1	Oct.	1948	39
Capital Formation in the Petroleum Industry, Joseph E. Pogue and Frederick G. Coqueron	922.	3	Dec.	1948	60
Export Men Have Unique Organization, Richard Sneddon	961.21	2	Nov.	1948	150
Wyoming Oil and Gas Regulations, W. H. Everett	986.	2	Nov.	1948	47
Who Were These Pioneers? Harry Botsford	991.	1	Oct.	1948	188

AUTHOR INDEX

Author—	Page
Adams, Ernestine	
Vol. 20, No. 1	45
Vol. 20, No. 2	37
Vol. 20, No. 3	41
Ambrose, Z. C.	
Vol. 20, No. 3	220
Anonymous	
Vol. 20, No. 1	105, 168, 190, 264, 290, 341, 355
Vol. 20, No. 2	126, 188, 255
Vol. 20, No. 3	124, 243, 262
Arthur, M. G.	
Vol. 20, No. 1	142
Attaway, Don	
Vol. 20, No. 2	252
Ayres, Eugene	
Vol. 20, No. 3	203
Bailey, F. G.	
Vol. 20, No. 3	53
Ball, John S.	
Vol. 20, No. 2	229
Beach, Floyd K.	
Vol. 20, No. 1	125
Bednarski, V. N.	
Vol. 20, No. 1	192
Berg, Clyde	
Vol. 20, No. 3	214
Boice, John E.	
Vol. 20, No. 3	258
Botsford, Harry	
Vol. 20, No. 1	188
Caraway, Ed	
Vol. 20, No. 1	156
Carney, William M.	
Vol. 20, No. 2	246
Cochrane, H. G.	
Vol. 20, No. 3	128
Coqueron, Frederic G.	
Vol. 20, No. 3	60
Cozzens, F. R.	
Vol. 20, No. 1	184
Crichton, Jack A.	
Vol. 20, No. 1	208
DeGolyer, E.	
Vol. 20, No. 3	148
Dale, Orie O.	
Vol. 20, No. 2	168
DeLoach, O. C.	
Vol. 20, No. 1	286
Dickinson, L. R.	
Vol. 20, No. 3	254
Edmister, Wayne C.	
Vol. 20, No. 3	193
Eriksen, Arne	
Vol. 20, No. 1	278
Espach, Ralph H.	
Vol. 20, No. 2	229
Everett, W. H.	
Vol. 20, No. 2	47
Fagin, K. Marshall	
Vol. 20, No. 2	141
Vol. 20, No. 3	115
Foster, Arch L.	
Vol. 20, No. 1	274
Vol. 20, No. 2	236
Gamble, M. G.	
Vol. 20, No. 2	276
Garbutt, Irving	
Vol. 20, No. 2	154, 271
Goldtrap, W. A.	
Vol. 20, No. 1	269
Griffin, W. H.	
Vol. 20, No. 2	117
Gruy, Henry J.	
Vol. 20, No. 1	208
Heiser, A. J.	
Vol. 20, No. 1	222
Hill, A. M.	
Vol. 20, No. 2	273
Hirsch, Joel H.	
Vol. 20, No. 3	203
Hoge, A. Wesley	
Vol. 20, No. 1	293
Vol. 20, No. 2	246
Irvine, O. C.	
Vol. 20, No. 2	278
Jones, E. L.	
Vol. 20, No. 1	269
Kelso, George	
Vol. 20, No. 1	293
Love, Frank H.	
Vol. 20, No. 1	321, 325
Vol. 20, No. 2	282, 296
Vol. 20, No. 3	245
Lynton, Edward D.	
Vol. 20, No. 1	170
Mills, Kenneth N.	
Vol. 20, No. 3	142
Montgomery, C. W.	
Vol. 20, No. 3	203
Myers, G. D.	
Vol. 20, No. 1	293
Neurath, F.	
Vol. 20, No. 2	132
Noll, Henry D.	
Vol. 20, No. 2	246
Peavy, C. C.	
Vol. 20, No. 1	293
Perkins, C. S.	
Vol. 20, No. 1	139
Pogue, Joseph E.	
Vol. 20, No. 3	60
Reed, Homer	
Vol. 20, No. 3	214
Reed, R. M.	
Vol. 20, No. 1	278
Ruby, Glen M.	
Vol. 20, No. 1	164
Sawdon, Wallace	
Vol. 20, No. 3	139
Schulze, R. K.	
Vol. 20, No. 1	330
Slattery, John J.	
Vol. 20, No. 1	158
Smith, S. S.	
Vol. 20, No. 1	330
Sneddon, Richard	
Vol. 20, No. 1	182, 242, 340
Vol. 20, No. 2	150, 177
Struth, H. J.	
Vol. 20, No. 1	39
Thomas, Horace D.	
Vol. 20, No. 2	128
Thompson, Claribel	
Vol. 20, No. 3	157
Torrey, Paul D.	
Vol. 20, No. 2	190



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GENERAL

U. S. Companies Expand Foreign Operations, H. J. Struth 39
Roundup of World Oil Activities, Ernestine Adams 45
Fuel Oil for Diesel Locomotives in Relation to the Supply of Petroleum 105

Features

Course of Oil 4
Scanning Washington's Oil Horizon 6
Highlights in Oildom 8
National Petroleum Situation 10
Petrolic Personalities 12
Meetings 14
Oil Field Operations 16
Laugh with Barney 54
Machinery and Equipment 71
Trade Literature 84
Book Reviews 87
The Petroleum Engineer's Continuous Tables (Installment No. 136) 89
Petroleum Profiles 120

EXPLORATION, DRILLING, AND PRODUCTION

Canada, 1948, Floyd K. Beach 125
Paraguay Diary, C. S. Perkins 139
Economics of Cycling, M. G. Arthur 142
Calculation of Pumping Unit Engine Drives, Ed Caraway 156
Mexican Oil Increase Due to Poza Rica Field, John J. Slattery 158
Pipe Line Problems Affect Chile's Oil Development, Glen M. Ruby 164
International Scholarships Improve Trade Relations 168
Two Years in France, Edward D. Lynton 170
Third Well Drilling in the Paraguayan Chaco, Richard Sneddon 182
Dry Hole Survey Lessens Water Flooding Hazards, F. R. Cozzens 184
Who Were These Pioneers?, Harry Botsford 188
Interesting New Discoveries in Venezuela 190
Measurement of Mud Viscosities at High Temperatures, V. N. Bednarski 192
A Critical Review of Methods Used in the Estimation of Natural Gas Reserves, Henry J. Gruy and Jack A. Crichton 208
Advancement in Contract Drilling, A. J. Heiser 222
Offshore California Gets Geophysical Survey, Richard Sneddon 242
Australasia 264

Features

Editorial 123
Running Tour with Men in the Industry 226
Geophysical Activities 252

REFINING AND GAS PROCESSING

Self-Contained Naphtha Polyforming Correlation, W. A. Goldtrap and E. L. Jones 269
Synthetic Glycerin Plant Goes on Stream, Arch L. Foster 274
Hydrogen and Synthesis Gas Production, R. M. Reed and Arne Eriksen 278
Catalytic Polymerization New McMurrey Unit, O. C. DeLoach 286
Heater Box for Control Valve 290
Design and Operation of Leonard TCC Unit, George Kelso, C. C. Peavy, G. D. Myers, and A. W. Hoge 293

Features

Editorial 267
Personals 302
Plant Aids 310

PIPE LINE AND MARINE TRANSPORTATION

Argentine 1100-Mile Pipe Line, Frank H. Love 321
Middle East Pipe Lines, Frank H. Love 325
Interfacial Mixing Characteristics of Products in Products Pipe Line—Part 2, S. S. Smith and R. K. Schulze 330
Ingenious Gas Line Leak Detector Proves Effective, Richard Sneddon 340
Alaska Standard Has First Major Overhaul in 24 Years 341
MODERN STATIONS—New Stations in Utility Line Service 355

Features

The Firing Line 319
With the Pipe Line Contractors 343
Marine Operations 347
Pipe Line Pictorial 350
Pipe Line Projects 352
Pipe Line and Marine Transportation Personals 354

Science Library
TN
860
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The make-up of this month's issue follows that of the Complete magazine—which covers all divisions—as it will be published under the new plan.

Editorial coverage in the three specialized magazines will include the General Section along with the respective Specialized Section as it appears in this issue.

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SCANNING WASHINGTON'S OIL HORIZON

By MILBURN PETTY

WASHINGTON—Now that it is all over but the shouting, with Governor Dewey's election assured, there is much speculation here as to the Republican presidential nominee's plans on petroleum when he enters the White House.

There are not many clues as to Dewey's views. But he does come from the largest consuming state where the people were practically hysterical at times during the fuel oil shortages last winter. So, he is oil-conscious from the consumers standpoint, anyway. And with the foreign situation worsening, he likely will listen to the military's suggestions for assuring adequate oil supplies for national defense, present and future.

Dewey on oil. One hint as to Dewey's oil views was in his Denver speech on conservation. He cited the heavy wartime drain on our resources and urged that something be done to restore the damage. He indicated that his administration would have "a brand-new approach and a comprehensive national program of conservation" but gave no details.

Oil was uppermost in Dewey's mind then because he immediately swung into a discussion of oil's importance in peace and war. He expressed "deepest concern" over the fact that the United States had become an oil-importing nation.

Dewey chided the Truman Administration for setting up one bureau after another to deal with oil, saying, "there are twelve of them right now." (He was understating the situation because there are at least 48 federal agencies here now having something to do with oil—and that doesn't include the National Petroleum Council, an industry advisory agency, which Dewey included by mistake in his list.) Dewey indicated that he favored a central oil agency to handle all the federal government's oil activities. He promised that his administration would "devote itself seriously to a wise and intelligent use of oil reserves of this country, in the closest cooperation with the States of the Union."

What Dewey had in mind is not clear. But oil men fear that the setting up of a central oil agency would be an open invitation to Congress, in a moment of hysteria, to vote federal oil controls and place their administration in the waiting hands of the new agency.

Military's view important. There was one general statement in Dewey's Denver speech which, if applied to oil, fits in with the thinking of the military. "Now, we must set about restoring the damage," said Dewey, referring to the war drain on our resources.

The military wants to restore the reserve crude productive capacity—the million barrels a day potential in excess of demand—which the U. S. had at the start of Word War II.

Mostly, the military has spoken vaguely of building up U. S. productive capacity and importing as much crude as possible. Now, a new approach is being considered by the National Security Resources Board, top-level advisory agency to the President. It is in a staff report, largely the work of Wallace Pratt (SONJ) who was NSRB's petroleum consultant until recently.

The Pratt Report suggests that, beginning in 1952 (when there will be surplus crude productive capacity in the Middle East), the state regulatory authorities should cut back domestic production below MER (a 20 per cent cut was suggested) to provide a stockpile in the ground that could be drawn upon in an emergency. Deficit in U. S. supplies would be made up by imports from the Middle East. Domestic producers would be compensated with a higher crude price for their reduced output.

NSRB report draws fire. News of this suggestion in the Pratt Report brought immediate protests from domestic producers. It was condemned as "impractical" and "beneficial only to certain large American foreign operators seeking to capture the domestic crude oil market."

But there were other angles of the Pratt Report not so displeasing to the domestic producer—its defense of high prices for crude, for example. The report said it was imperative that a "generous" price be maintained to keep the domestic industry strong and provide the wherewithal for exploration and development. During the next few years, there should be the maximum possible diversion of materials and manpower to the oil industry, domestic and foreign.

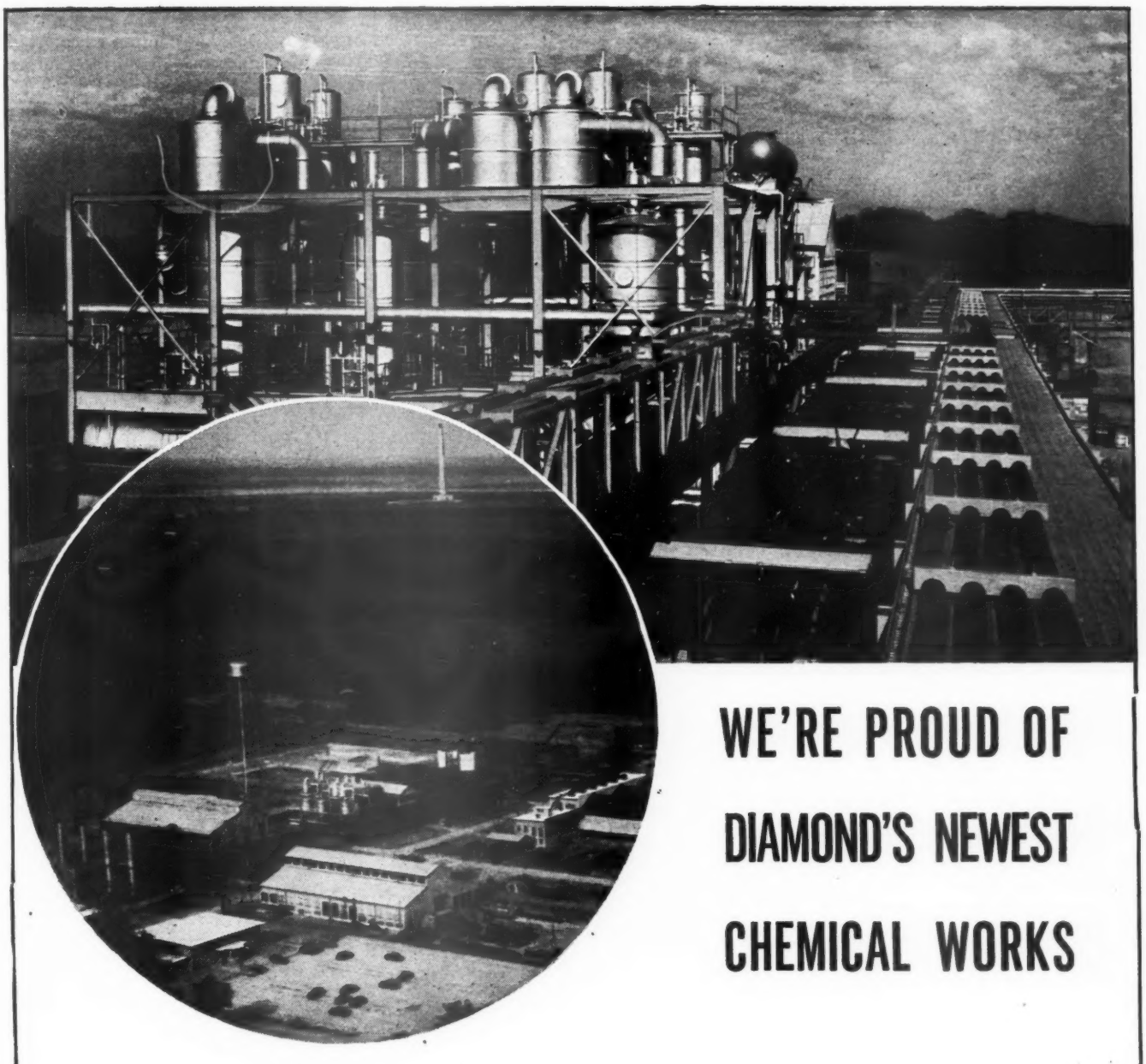
Pipe lines to consuming centers should be built to utilize all the natural gas available, releasing fuel oil for use as fuels for internal combustion engines. Encouragement of the coal industry to recapture its markets was advocated. A million barrels daily of oil is being "wasted" by burning under boilers and national interest requires that this be eliminated, the NSRB report urged.

The report's discussion of "superior" and "inferior" uses of petroleum has aroused fears in some quarters that it may become ammunition for "end use" controls.

Federal oil control is unnecessary and undesirable, the NSRB report insists. But it is open to question whether some of its objectives can be attained without some kind of federal regulations.

Stockpiling. There are indications that the military is going ahead with its long-expected stockpiling of key products. Navy has a $10,000,000 tank program. Representatives of the other services have been shopping around for storage. Avgas requirements of the Berlin airlift have put an increasing strain on supplies. Hundreds of thousands of barrels of production have been lost, which cannot be made up, by the California strike which forced nearly all refineries there to produce only regular grade gasoline. There is much talk of building a stockpile of avgas to take care of some unexpected happening, like the Berlin airlift, but that may require some organized plan such as during the war. If the military wants to build up a 90-day stockpile (over and above current requirements), it will require many millions of barrels of products, which will make a dent in civilian supplies, not to mention shifts in refining yields.

Meanwhile, Director Max W. Ball of Interior's Oil and Gas Division, gives this as his latest forecast: "If this winter is no more severe than last, and if we have no major strikes in addition to the present one in California, and no more Texas City disasters, and if military needs are not unexpectedly high, then no one in the United States should be short of kerosine or fuel oil this winter."



WE'RE PROUD OF DIAMOND'S NEWEST CHEMICAL WORKS

Diamond Alkali Company's newest chemical plant, the Houston Works on the Houston Ship Channel, recently went on stream, manufacturing chlorine and caustic for what it's able young president, R. F. Evans, so aptly described as "the living, growing, expanding chemical industry." Brown & Root, Inc. are proud to have been selected for engineering and construction of this great plant—proud of the part we have in the process industry in the Southwest, which is fast securing its position as a world chemical capital.

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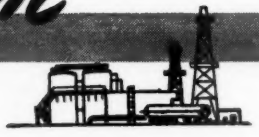

Offers Crude Price Increase. K. S. Adams, president of Phillips Petroleum Company, announced on September 28 the increase of 35 cents a bbl on all grades of crude oil in Texas, Oklahoma, Arkansas, and Kansas where the company purchased crude oil. Despite the fact that premiums of virtually the same amount were said to be made oftentimes no other company has so far met the posted Phillips increase.

The Texas Independent Producers Royalty Owners Association, which controls some 324,000 bbl of crude oil production a month in West Texas, has offered well connections to Phillips. The Independent Petroleum Association of America approved Phillips move to increase crude prices.

Again October 13, President Adams stated at Houston, Texas, that Phillips will stand by its recent hike in posted oil prices. Adams firmed up his company's position on the price of crude oil by saying, "We have no intention of backtracking. The oil posting is as fundamentally sound as it was the day it was announced," Adams said.

Activity in Foreign Countries Stimulated. Oil activities in many foreign countries are keeping up with the intensified operations of the U. S. industry. In the short time since the completion of the article on world oil events (Page 45) a number of interesting news items have appeared. Probably the most important is the discovery well brought in by Imperial Oil Company near Redwater in Alberta. It flowed 74 bbl an hour from the Devonian limestone at 3110 to 3131 ft. The well is 30 miles northwest of Edmonton and 50 miles northeast of Leduc. Canada is proving that if you give companies enough room to look for oil there is a good chance of finding it.

A note of interest is that crude oil in Leduc and a couple of other fields of Alberta have a new price of $3.47 a bbl, which is 2 cents over precious prices. Imperial posted the increase to take effect October 1.

Another recent move by a foreign country is that of the Brazilian government whose president announced that two oil refineries were being purchased, one from France and one from Czechoslovakia. In Holland production continues to increase at the new and only oil field.

Oil Statement by Dewey. When he was in Oklahoma October 13, Thomas E. Dewey told the oil-conscious audience: "I pledge to you an administration that will provide a well integrated and intelligent program for the wise use of oil reserves. That program will be based upon the closest cooperation of the state governments and the people themselves.

"In the interest of our national security we must increase our potential oil-producing capacity. We must also go on with research in the development of better methods of refining and secondary recovery, so that we can realize the full potentials of our oil supplies."

A Difference of Figures. Brazil has a bill in its congress asking for $2,000,000 to explore and develop its oil resources.

Sun Oil Company released a report this month stating it was spending $70,000,000 this year to maintain and increase output of petroleum for its customers. This is not the most any one company is spending but it is indicative of how much it costs to do the job.

The point here is that Sun is responsible to its stockholders and Brazil must please its voters. Think how Congress would balk at passing on an appropriation for $4,000,000,000 in one year to expand oil and gas operations. Yet that is what the industry is spending.

An Addition of Figures. Comes Marion E. Dice, General Petroleum's top economist, with some plain adding and subtracting that should be seen before someone gives them a pessimistic twist. Here they are:

1936—California reserves, 2,956,000,000 bbl
1936-1947—California production, 2,988,000,000 bbl.
1947—California reserves, 3,295,000,000 bbl

Without finding a single major field the California oil industry has produced and developed 6,283,000,000 bbl of oil in 11 years.

Steel Shortage Still Leads. Lack of steel tubular goods is a number one problem of the Independent Petroleum Association of America, stated Merle Becker, president, at the 19th annual meeting of the association, September 27, at San Antonio, Texas.

The following Becker named as the foundation for work in prospect during the coming year:

"The biggest problem carried over into the new year is the question of sufficient steel tubular goods to allow for a proper rate of exploratory and development well drilling.

"Taxes are essential to our form of economy; however,

Continued on Page 15

Strange Fruit. *Samples from a location where the derrick succumbed to a strong wind were hung in a tree for scouts to pick up. Only one derrick in Fish Creek field, north of Breckenridge, Texas, was destroyed by the storm.*

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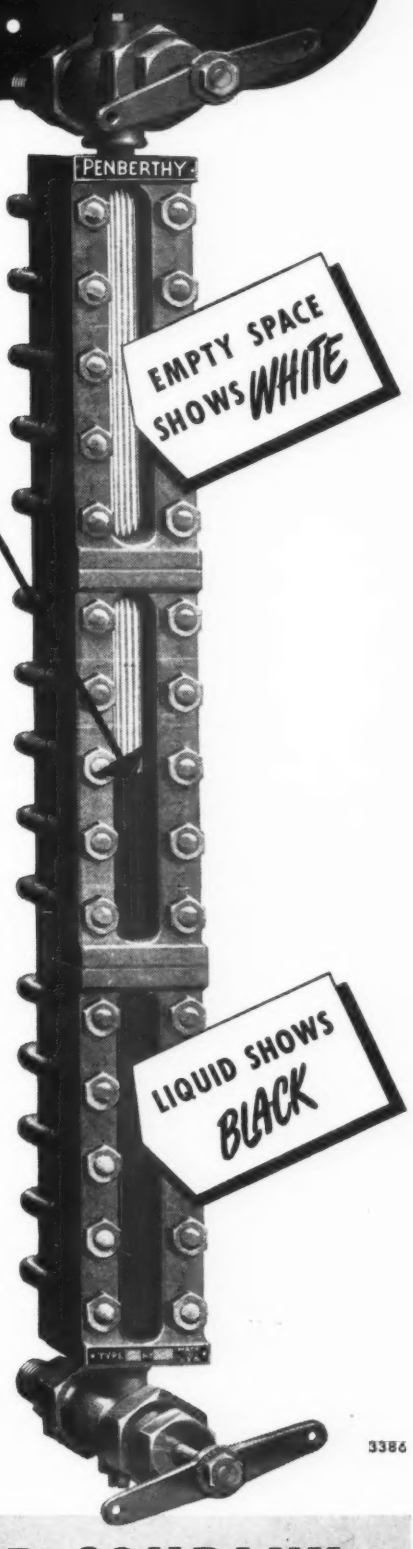

The refraction of light (an unvarying law of nature) makes the reading of Penberthy Reflex Gages unmistakable. Due to this refraction principle, the empty space always shows white—the space occupied by liquid always shows black. The dividing line between liquid and empty space is sharp and unmistakable, there can be no error in reading. It is easily read as far as you can distinguish between black and white.

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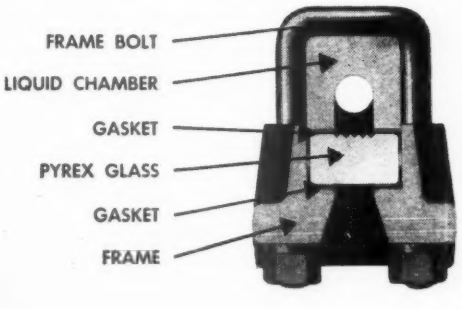

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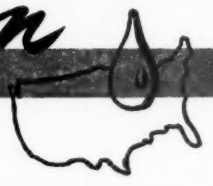


By H. J. STRUTH*,
Petroleum Economist

▸ **CALIFORNIA STRIKE LOSSES.** Refinery workers on strike in California have lost in September about $7,500,000 in wages and have deprived the public of at least 400,000,000 gallons of petroleum products. Facts available from reliable sources indicate that California refinery still runs in September were reduced to the tune of about 387,000 bbl daily. Runs apparently averaged about 473,000 bbl daily, against a normal refinery throughput of about 870,000 bbl daily. Efforts of the California oil industry to meet consumer requirements in September reduced motor fuel stocks 4,219,000 bbl and caused withdrawals from fuel oil storage of about 2,600,000 bbl.

▸ **WINTER SUPPLY ADEQUATE.** Despite inroads on fuel oil stocks in California, due to the refinery strike, the nation's fuel oil supply situation appears to be satisfactory. Refining operations outside of California have been increasing steadily and stocks of distillate and residual fuels have been built up to levels that are considered more than adequate to meet this winter's requirements. Increased runs in non-strike districts partially offset the sharp decline in California. National runs in September averaged about 5,293,000 bbl daily, against 5,615,000 bbl daily in August. Combined fuel stocks on September 30 were 8,740,000 bbl greater than at the close of August. Compared with a year ago, U. S. fuel oil stocks are 28,600,000 bbl greater and totaled nearly 141,000,000 bbl on October 1.

▸ **WHAT PRICE CRUDE?** Phillips Petroleum Company's 35-cent advance in crude postings is being resisted by most other major purchasers. While many producers have acclaimed the increase as necessary to their economy, a large number of refiners say they cannot pass an increase in crude to consumers. The facts are that refiners' margins are no better, and in many instances, worse than in 1941 and any further increase in costs at this time would seriously affect present margins. Most marketing companies agree that retail prices of gasoline and fuel oils have reached maximum price levels and consumer resistance in all lines is not favorable to further price boosts.

*Editor, *The Petroleum Data Book.*

Comparative Statistics, September, 1948

*All figures are computed on a Bureau of Mines' Basis**

	Sept. 1948℗	August 1948℗	Sept. 1947	This year to date	Last year to date	Per cent change
Wells drilling	4,780	4,790	4,450	4,780	4,450	+ 7
Total wells drilled	3,477	3,564	2,844	28,147	24,242	+16
Development wells	2,758	2,781	2,134	22,057	18,917	+17
Oil	1,856	1,871	1,429	15,265	12,654	+21
Gas	247	258	266	1,865	2,360	−21
Dry	655	652	439	4,927	3,903	+26
Per cent dry	23.7	23.4	20.6	22.3	20.6	+ 1.7
Service wells	163	155	232	1,525	1,571	− 3
Wildcat wells	556	628	478	4,565	3,754	+22
Oil	76	106	86	707	603	+17
Gas	21	26	21	194	149	+30
Dry	459	496	371	3,664	3,002	+22
Per cent dry	82.6	79.0	77.6	80.3	80.0	+ 0.3
Crude supply*	172,580	182,050	166,188	1,580,577	1,440,286	+10
Daily average	5,753	5,873	5,540	5,769	5,276	
Crude demand‡	166,150	181,440	169,579	1,574,501	1,440,010	+ 9
Daily average	5,538	5,853	5,653	5,746	5,275	
Crude stocks	236,730	230,300	230,452	236,730	230,452	+ 3
Days supply	43	39	41	43	41	
Natural gasoline production	11,250	11,940	11,046	105,884	96,157	+10
Daily average	375	385	368	386	352	
Motor fuel production	73,670	80,880	72,944	680,036	617,029	+10
Daily average	2,456	2,606	2,432	2,482	2,260	
Gasoline yield, per cent	41.2	41.2	40.5	40.0	39.9	+ 0.1
Motor fuel demand‡	79,490	84,256	74,828	680,225	626,424	+ 9
Daily average	2,650	2,718	2,494	2,483	2,295	
Motor fuel stocks	87,290	93,110	80,338	87,290	80,338	+ 9
Days supply	33	34	32	33	32	
Fuel oil production	62,200	71,170	64,423	628,082	555,727	+13
Daily average	2,073	2,296	2,147	2,292	2,036	
Fuel oil demand‡	59,760	61,876	64,478	646,467	619,629	+ 4
Daily average	1,992	1,996	2,149	2,359	2,270	
Fuel oil stocks	140,840	132,400	112,342	140,840	112,342	+25
Days supply	71	66	52	71	52	
Refinery still runs	158,790	174,050	159,771	1,507,058	1,364,815	+10
Daily average	5,293	5,615	5,326	5,503	4,999	
All refined stocks	328,670	322,360	282,869	328,670	282,869	+16
Days supply	58	55	49	58	49	

Supply and Demand—All Oils

	Sept. 1948℗	August 1948℗	Sept. 1947	This year to date	Last year to date	Per cent change
Total supply, all oils	188,160	198,120	181,186	1,730,875	1,582,532	+ 9
Daily average	6,272	6,391	6,040	6,317	5,797	
Total demand‡, all oils	175,420	181,960	178,521	1,666,275	1,576,305	+ 6
Daily average	5,847	5,870	5,951	6,081	5,774	
Change in stocks	+12,740	+16,160	+2,665	+64,600	+6,227	

Current Crude Oil Prices

U. S. average	$2.61	Louisiana	$2.62
Texas	2.61	Arkansas	2.43
California	2.42	New Mexico	2.40
Oklahoma	2.63	Mississippi	2.42
Kansas	2.62	Illinois	2.76
		Other states	3.15

Basic crude prices:

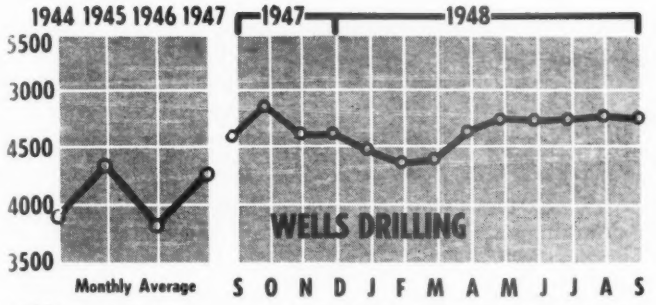
Oklahoma-Kansas (36 gr.)	$2.57
Texas Gulf Coast (36 gr.)	2.86
East Texas	2.65
West Texas (36 gr.)	2.44
California Signal Hill (26 gr.)	2.41
Pennsylvania, Bradford	5.00

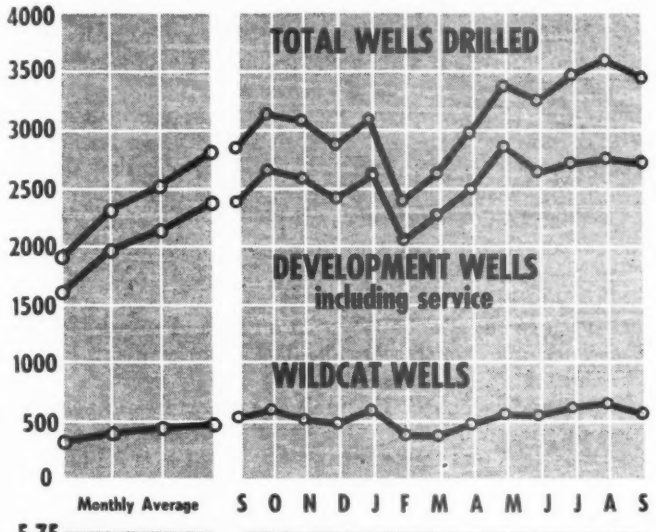
Drilling and Production Statistics by States

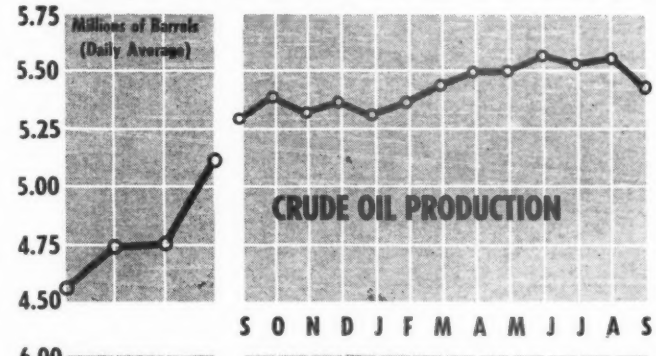
	Sept. 1948℗	August 1948℗	Sept. 1947	This year to date	Last year to date	Per cent change
Wells drilled (excl service)	3,314	3,409	2,612	26,622	22,671	+17
Arkansas	31	31	33	227	225	+ 1
California	225	264	168	2,134	1,447	+47
Illinois	235	225	190	1,739	1,491	+17
Kansas	290	262	219	2,271	1,844	+23
Louisiana	225	213	152	1,697	1,141	+49
Mississippi	37	44	35	305	368	−17
New Mexico	45	47	53	446	413	+ 8
Oklahoma	370	392	303	3,046	2,878	+ 6
Texas	1,098	1,077	737	8,739	6,965	+25
Other states	758	854	722	6,018	5,899	+ 2
Wildcats drilled	556	628	478	4,565	3,754	+22
Arkansas	6	16	9	74	49	+51
California	44	55	28	336	254	+32
Illinois	41	55	41	311	326	− 5
Kansas	39	53	37	369	296	+25
Louisiana	21	34	26	218	211	+ 3
Mississippi	11	16	11	76	71	+ 7
New Mexico	4	5	6	44	35	+26
Oklahoma	69	72	91	612	622	− 2
Texas	223	236	155	1,873	1,355	+38
Other states	98	86	74	652	535	+22
Daily crude production	5,419	5,550	5,251	5,452	5,007	+ 9
Arkansas	87	85	84	86	81	+ 6
California	781	947	915	925	908	+ 2
Illinois	182	179	179	176	183	− 4
Kansas	302	310	297	300	286	+ 5
Louisiana	498	502	444	488	431	+13
Mississippi	129	128	103	123	92	+34
New Mexico	132	133	120	129	109	+18
Oklahoma	429	425	395	415	380	+ 9
Texas	2,484	2,461	2,357	2,439	2,202	+11
Wyoming	158	154	128	147	117	+26
Other states	237	226	229	224	218	+ 3

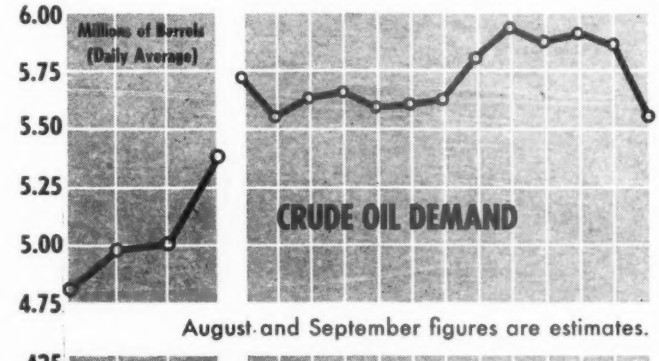
*Unless otherwise stated all figures represent thousands of barrels.
‡Total demand, including exports.
℗–Preliminary.
△Includes finished and natural gasoline.
•Includes domestic production and imports.
¶Revised.

Preliminary estimates based upon data supplied by American Petroleum Institute, U. S. Bureau of Mines, State Agencies, and other official sources.









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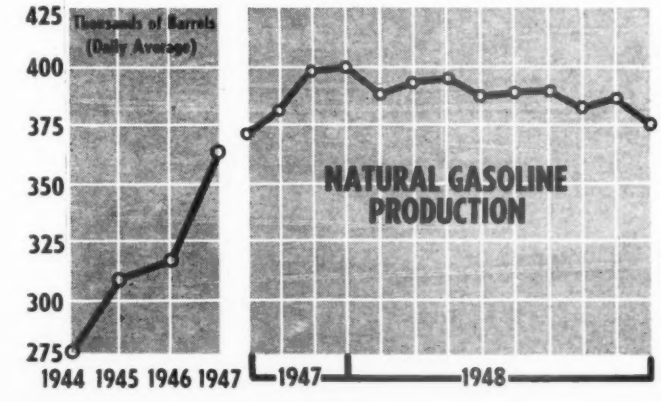
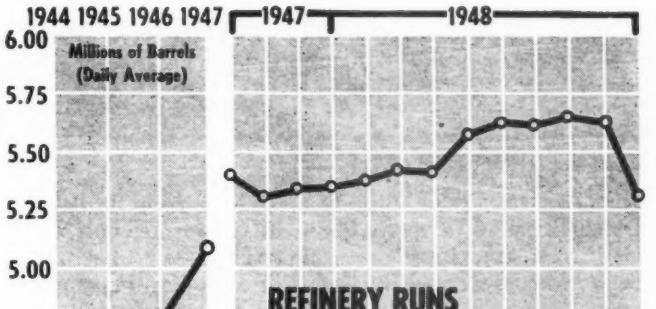
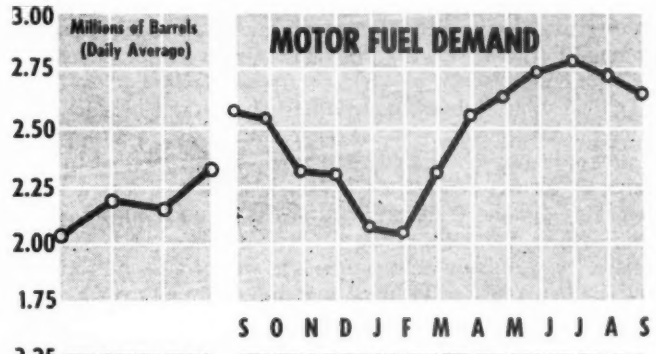
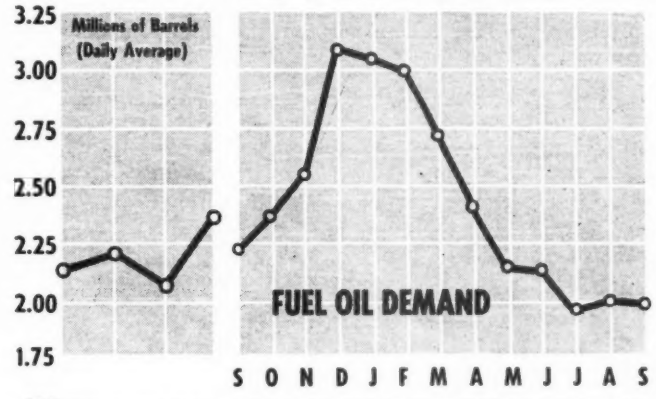
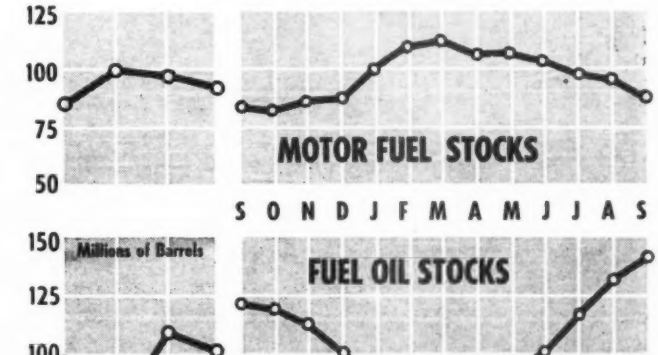
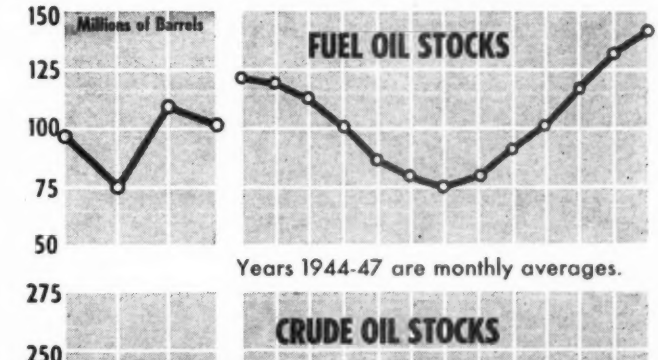




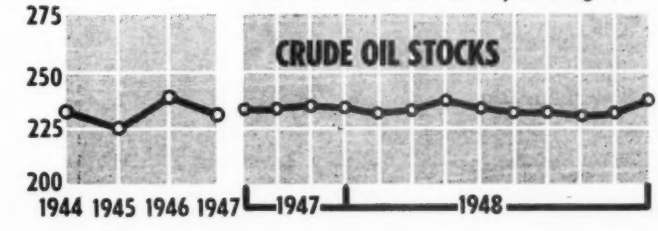








Years 1944-47 are monthly averages.



PETROLIC PERSONALITIES

DICK SNEDDEN

TED LEGATSKI, the Phillips research exec, from Bartlesville, Oklahoma, took a recent jaunt to California, only to be victimized—and in no uncertain manner—by what we underworld characters call a "dip," or as you ordinary people know the breed, a pock picket—er, excuse please, a pickpocket. Ted went to the City of Lost Angels to give a convincing earful to the CNGA members about the place of propane in the economic sun. He had done so, very eloquently, too, and was minding his own business in the Embassy Room at the ritzy Ambassador Hotel, when he was hailed by an Englishman with a small black mustache named Perry. It was the Englishman who was named Perry, y'understand, so far as we know the mustache had no name. Anyway, the nimble fingered lad who lurked behind it enticed Mr. Legatski on to the stage with an ingratiating smile and some smooth chatter, and forthwith proceeded to frisk him of all his immediate possessions. Perry was a sharp worker and the transfer of goods was made in amazingly quick time, yet without the slightest evidence of how it was done. Just to show how simple was the process he returned all the items he had pilfered and stole them all over again—and again with dizzying frequency. From where we sat, it didn't appear that Mr. Legatski, even with his searching mind, was finding out much about the modus of this lucrative pastime.

ANOTHER CHAP who ran afoul of the aforesaid dip with entertaining results was Tom Taggart, the San Francisco Hibernian, who heads Standard of Cal's natural gas and gasoline department, and is also chief inciter of the national barber shoppers up in the Bay area. Tom is trivalent—he very readily attracts to himself three other radicals and becomes a quartet. It will be understood, of course, that the radical here referred to is not of the red type, and that the function of a quartet is to preserve to an unwitting posterity certain lugubrious ballads, notably "Sweet Adeline," "She Wore a Tulip," and "Dear Old Pal." This they do by standing in close formation, with faces not more than four inches apart, and sporadically emitting a species of crescendo diminuendo that has come to be known (to the quartets) as harmony—it probably takes its name from the word "harm." But this is no place for a technical discussion. What we really started out to say was that Tom is a gifted chap, who has a good voice, plays an accordion like a professional, has a wooden putter that is feared by every divot digger in the oil industry, and is one of the most popular petrolic personalities on the Pacific Coast. We had further intended to say that Perry, the pickpocket, stripped Tom of everything but his clothes, even undoing the buckle and removing his wrist watch undetected, if you please. It was a clever performance. In fact, Gordon Greene and his entertainment committee

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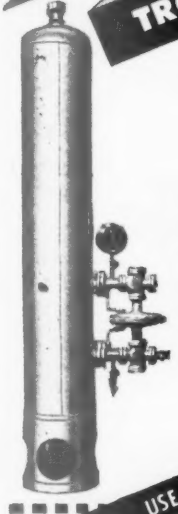

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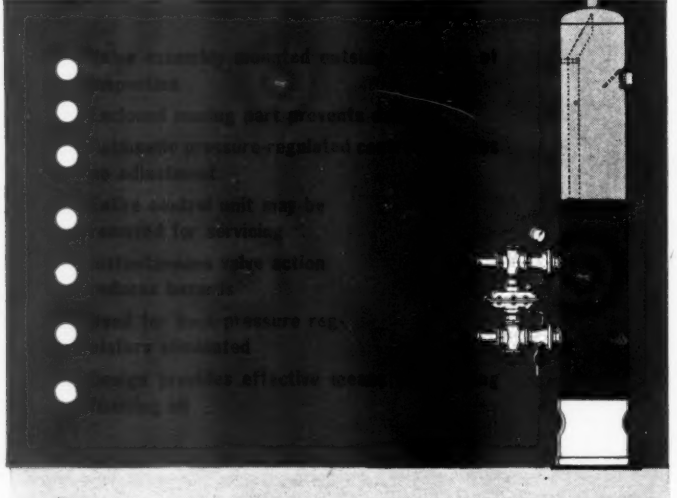

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trotted out one of the best vaudeville shows we have seen in many a moon, and the entire CNGA fall meeting in all its aspects was what the literati call "a dilly."

IT WOULD be a heinous offense to broach the general topic of sweet singing without a mention of that rare soul, Bill Lowe, the NGAA secretary from Tulsa, Oklahoma, who goes out to the Coast ever and anon, and seasons the air no end with his intriguing tenor. Bill is a pleasant, easy to get acquainted with, sort of a chap, who never needs any special dispensation where and when he is visiting. He just naturally fits into the local scene as if he belonged, and no matter what the occasion may be, so long at least as it is proper, he has more fun than a pelican in a fish hatchery. His singing voice is so high and so true, that it has a refining effect on the baser outbursts with which it frequently has to mingle, and he knows more sob songs of yesterday than Beatrice Kay. So, to any incipient foursome that is weak in its chords he is a tower of tonal strength. He is also a proponent of the ancient and honorable game of golf, for which, we are told, he trains assiduously by throwing an occasional aspirin tablet out on the lawn and then searching until he finds it. Bill really believes that the clod smacking pastime is one of the most healthful pursuits extant, and certainly nobody will deny that it is a pursuit. As to its healthfulness, the record shows that the death rate among golfers has never risen above the astonishingly modest rate of one per person.

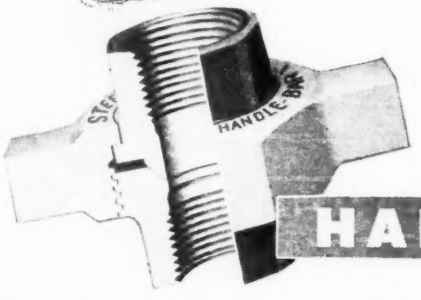
THE CNGA fall meeting opened with a press conference ably staged by Herb Eggleston and Ed Millett, Jr., and featuring R. S. "Bob" Tulin, the Shell Company exec, in a disquisition on the present status of the natural gas and gasoline industry. Bob did a neat job, which was not at all surprising—he always does. The other speakers, Ted Legatski, Howard Kehde, and Ludwig Kniel, stood by to lend a hand should any unusual questions be popped, but Bob Tulin handled very adequately everything that came his way. Present to meet the press men were Dick Williams, prexy of NGAA, and a pretty sharp performer on the pitch and putt course; Bill Lowe, whose qualifications have already been cataloged; a sizable representation of CNGA directors, including among others, affable Andy Kirk, Red Taylor, Walt Dayhuff, Val Cassaday, Frank Colton, Dick Enderley, Clare Gard, Ron Heath, Frick Gibbs, Jim Kibre, George McLaren, D. M. Wolfe, and Ross Furlong. We were pleased to recognize Glen Hile, now with the California Company in New Orleans, and D. M. Wolfe of Standard of Cal, with whom we made an inspection of Union Oil Company's gasoline line from Kettleman Hills to San Luis Obispo, just after it was completed many years ago. Present on that occasion also was Joe Scanlan, Texas Company's refinery superintendent at Fillmore, a gentleman—and a scholar, with a tremendous vocabulary. We hadn't yet debauched into the writing business so we failed to make record of his colorful descriptives during the trip, but we do distinctly remember his remarking in one of the pipe line laboratories that "the aroma of carbon bisulphide was enough to nauseate a vulture."

SITTING UP front at the World Baseball Series was Jim Wirtensohn, general drilling superintendent of Caribbean Petroleum Company, Maracaibo, Venezuela, who has been doing the U. S. on his long leave. His territory, when on the job, includes Casigua, La Concepcion, Cabimas, Lagunillas, Tia Juana, Mene Grande, and Bachaquero, and at this writing, we are told, he has 24 drilling wells to look after. While visiting here, he spent some of his time contacting prospective employes and the rest of it renewing old acquaintances. At the conclusion of the baseball classic, he will return to Venezuela on one of the Grace liners. And, referring back to the ball game, when our little high school team scrambled into the district finals this summer, the local paper announced that "the team left for the County Seat on September 3, 1948, accompanied by some 500 *rotters*." Having gone along with the gang, we certainly hope that the word rotters was a slip and not a slap of the pen. On the subject of foreign travel, we hear tell that Ted Forsyth, the genial Emsconian, who so efficiently purveys liquid pleasure for the Petroleum Pioneers, is now traipsing around Peru, accompanied by Red Metcalf and Norman Yett. He is expected in Caracas toward the end of October and hopes to make the U.S.A. in time to do the API convention. If he is back on the Coast for the Christmas meeting of the Pioneers, we shall take the usual delight in fixing his 1890 hairdo with rare artistry—and a china marking pencil.

SPEAKING OF THE PIONEERS, some 600, more or less, assembled in unbridled conclave at Camp Comfort, near Ojai, California, on Saturday, September 25, and enjoyed as nice a steak dinner as ever was served within the confines of Ventura County. The meat was removed gently from the torsos of contented young Santa Maria steers by that prince of procurers, Bill Butler, and was promptly turned over to Fritz Huntsinger for his very special handling. Fritz, a sirloin sculptor of exceptional ability, gathered around him an amazing band of epicures—among them George Ruggels, Bob Jackson and Alex McLean—and armed with sharp knives and condiments, they whittled and seasoned until nothing remained but the purest of vitamins, the sheerest of proteins, and a phosphate or two. We might mention, *en passant*, as it says in our French dictionary, that a few days after cooking up this delectable mess of pottage for the Petroleum Pioneers, Fritz Huntsinger did it all over again at his Ventura home for his buddy, Governor Warren. Oh, well, we used to associate with royalty occasionally—once we sat with three kings in a game of draw and lost all our pride when some commoner popped up with four deuces.

WHILE THE KITCHEN crew strutted their culinary stuff, Fred Miller of Continental fame, rigged up a good looking green dispensary from behind which George Trembley, Charlie Perkins, Hudson Drake, John Hills, and Ed Abbott ladeled out liquid good humors with a fine abandon—and there were plenty of takers. A cruel fate had attempted to sabotage this party — postponements, plagues, fire, and strikes all reared their ugly heads and tried to squash it—but Ox Morgan, Swede Larson, Chris Rector and their several arrangers refused to be stopped. And it turned out to be one of the best fandangoes ever staged by the organization. Old timers came out of the derrick groves in swarms and met countless other old timers from other derrick groves. Then followed such an orgy of yarns about rope chokers, swivel necks, and mud smellers, as hasn't been heard since the sticky demise of Paul Bunyan. Everything was right; Camp Comfort was well named, and the Ventura boys had left nothing undone. The only thing that went wrong was the loud speaker, in consequence of which Jim Gosline was unable to say a word of welcome to the guests—but they made themselves welcome anyway. Dick Guiberson was unable to introduce his new Pioneer song, but we'll have a better chance to learn that at the Christmas shindig when we are inside. Taking everything into account, the Ventura outing was a pronounced success, and because of it, Joe Siegel, the hard working membership chairman, has a host of new members to add to the already formidable roster of the organization.

OF DEPENDABILITY WITH THESE PRECISION BUILT, EXTRA HEAVY FORGED STEEL UNIONS



HANDLE-BAR

Sizes 3/8" to 4"

These easy to handle Hi-Speed Handle-Bar Unions have integral steel to steel seats, or completely fused bronze to bronze seats. The nut threads are modified Acme to facilitate easy and speedy assembly and disassembly. The seat design is a 45 degree cone, machined and cold rolled, to a ball seat on the male end. Furnished in black hub ends with Udylited nut, or all rustproof with Udylited hub ends and Parkerized nut.

4000 Test Unions sizes 3/8" to 4" inclusive are furnished with Briggs Standard steam threads in pipe ends.

6000 Test Unions sizes 2" to 4" inclusive have long pipe ends with A.P.I. line pipe threads.

HANDLE—BAR Unions are recommended for all services. Use a hammer instead of a wrench to tighten or loosen the nut.

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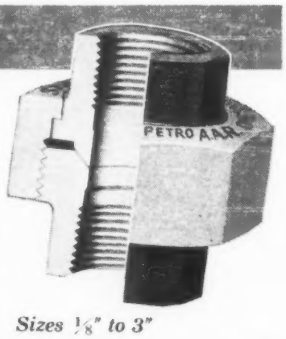

Sizes 1/8" to 3"

This Union has features that make it the most universally used Union. It is made to A.A.R. standards with integral steel to steel seats. The seat design is a 45 degree cone, machined and cold rolled, to a ball seat on the male end. The ends and nut are extra heavy and the nut threads are permanently lubricated and rustproofed with Udylite Cadmium.

A partial list of PETRO'S proven services include pressures from a vacuum to 3000 lbs.; Temperatures from 100° below zero, F., to 1000° above zero F.; on Steam, Gas, Air, Oil, Gasoline, Ammonia, Chemicals, and all other services in which Steel or Wrought Iron Pipe is used.

ORIFICE

Sizes 1/4" to 3"

"ORIFICE" Unions, screwed, or socket weld are widely used for flow control of Steam, Oil, Ammonia, Chemicals, Water, Gas and Air. Also for metering and measuring. The ORIFICE is recommended for working pressures of 600 lbs. at 900° F., or 2000 lbs. at 150° F. Furnished with 18-8 stainless steel orifice plate and steel jacketed asbestos filled gaskets. These are set in a groove of solid steel to facilitate ease of tightening and to safeguard against possible blowing of the gaskets and resultant trouble.

The nut threads are Cadmium plated (UDYLITED) for permanent thread lubrication.

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CLAYTON MARK & COMPANY

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MEETINGS

Nov. 1—Nomads, Louis Sherry's 50th Street and Park Avenue, New York.

Nov. 3-4—ASME, Fuels Division, Greenbrier, White Sulphur Springs, W. Va.

Nov. 4-5—SAE, Fuels and Lubricants meeting, The Mayo, Tulsa, Okla.

Nov. 7-10—American Institute of Chemical Engrs, Hotel Pennsylvania, New York City.

Nov. 8-11—API—annual meeting, Stevens Hotel, Chicago, Ill.

Nov. 10-14—Oil Industry Information Committee, national meeting, Chicago.

Nov. 18-19—Dallas Geological Society and Dallas Geophysical Society, Adolphus Hotel, Dallas, Texas.

Nov. 28—ASME, annual meeting, Hotel Pennsylvania, New York City.

Nov. 28—Dec. 3—Exposition of Chemical Industries, Grand Central Palace, New York.

Dec. 2-3—Petroleum Electric Power Assn, annual meeting, Biltmore Hotel, Oklahoma City, Okla.

Dec. 3—National Gasoline Association of America, regional meeting, Amarillo, Texas.

Dec. 4—Nomads, Christmas Party, Louis Sherry's, 50th St. and Park Ave., New York.

Dec. 9-11—Interstate Oil Compact Commission, annual meeting, Allis Hotel, Wichita, Kansas.

Jan. 10-14—SAE, annual meeting, Book-Cadillac Hotel, Detroit, Michigan.

Jan. 12—Institute of Petroleum, monthly meeting, Manson House, 26, Portland Place, London, W. 1.

Feb. 9—Institute of Petroleum, monthly meeting, Manson House, 26, Portland Place, London, W. 1.

Feb. 28-Mar. 4—ASTM, spring meeting, Hotel Edgewater Beach, Chicago, Ill.

Mar. 7-10—National Association of Corrosion Engineers, annual convention, Cincinnati, Ohio.

Mar. 9-10-11—API, Southwestern District meeting, Galvez Hotel, Galveston, Texas.

Mar. 17-18—Oklahoma Utilities Assn, Hotel Tulsa, Tulsa, Oklahoma.

Mar. 23-25—API, Mid-Continent District meeting, Mayo Hotel, Tulsa, Oklahoma.

Mar. 27-Apr. 1—American Chemical Society, spring meeting, San Francisco, Calif.

Mar. 28-30—SAE, Transportation meeting, Statler Hotel, Cleveland, Ohio.

Mar. 28-30—Western Petroleum Refiners Association 37th annual meeting, Plaza Hotel, San Antonio, Texas.

Apr. 11-13—American Society of Lubrication Engineers, annual meeting, Pennsylvania Hotel, New York.

April 11-15—Western Metal Congress & Exposition, Shrine Auditorium, Los Angeles, California.

April 12-14—Southwestern Gas Measurement Short Course, O. U., Norman, Oklahoma.

April 13-14-15—National Petroleum Association, Hotel Cleveland, Cleveland, Ohio.

Apr. 20-22—Southern Gas Assn, annual ica, annual meeting, Texas Hotel, Ft. Worth.

Apr. 20-22—Southern Gas Assn, annual convention, Buena Vista Hotel, Biloxi, Miss.

April 27-28-29—API, Eastern District meeting, William Penn Hotel, Pittsburgh, Pennsylvania.

May 12-13—API, Pacific Coast District meeting, Biltmore Hotel, Los Angeles, Calif.

May 26-27—API, Rocky Mountain District meeting, Gladstone Hotel, Casper, Wyo.

Continued from Page 8

we must be alert and vigorous in our protection of reasonable taxes levied against the petroleum industry.

"We must continue to watch the demand of the nation for petroleum and petroleum products, and must keep the public informed as to the actual status of the petroleum industry in this respect.

"It must continue to be our duty to correct the fallacies contained in such widely publicized comment as 'oil shortage' or 'we are running out of oil.'

"Your association has a greater responsibility in advising on matters pertaining to natural gas reserves, for this fuel has vitally increased its importance in the past few years.

"An understanding on the part of Congress and the people is necessary to the health of our industry and is an informative obligation which we should never neglect.

"The national oil and gas policy, which we have formulated and approved, should be our silent partner in the years ahead.

"Still another problem faces the domestic producer; imported oil. It is an issue that is not new. Your association is not opposed to imported oil, except when in such volume as to depress or retard the development of our own reserves here at home."

▸ **Demand Meets Its Match.** With the heavy gasoline consuming season drawing to a close, oil companies are preparing to meet a record demand for fuel oils this coming winter, the Oil Industry Information Committee said.

"Oil companies everywhere have broken all production records to meet the unparalleled demand for petroleum products this year, and, barring unforeseen circumstances, will continue to do so this winter," said the committee.

Domestic fuel oil demands this year are estimated at more than double what they were before the war and 20 per cent higher than they were last year, it reported, citing a recent nationwide survey. This means that fuel oil is consumed at an average rate of 41,000,000 gal every day of the year, the committee said, adding that consumption of all petroleum products averages close to 250,000,000 gal a day.

▸ **Your Choice.** Schlumberger employes had an opportunity to join the CIO oil workers union the other day. They were the first oil service employes to have an election held by National Labor Relations Board. More than three-fourths, 77 per cent to be exact, voted against joining.

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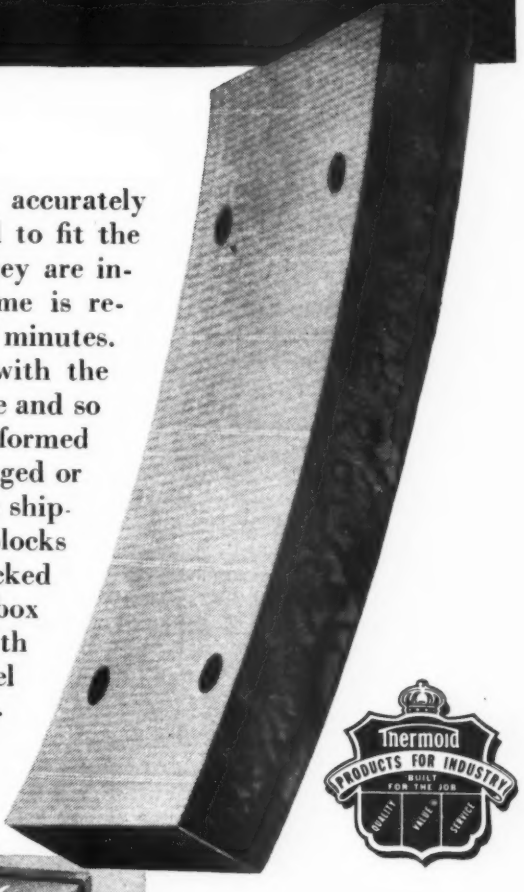
Brake Blocks
for ALL Oil Field Drawworks

Built to fit . . .

Thermoid Blocks are accurately formed and jig drilled to fit the machine for which they are intended . . . relining time is reduced to a matter of minutes. Each set is packed with the blocks stacked on edge and so protected that the pre-formed radius cannot be changed or the blocks distorted in shipment. Only enough blocks for one band are packed in a container. Each box is clearly marked with the make and model number of the equipment to be serviced.



No matter what make or model drawworks you use, there is a "Packaged Set" of Thermoid Oil Field Brake Blocks manufactured specifically for your machine. These blocks are designed to provide top operating efficiency and long life, even under the most severe service conditions.

Your oil field supply house will gladly help you with your service requirements.

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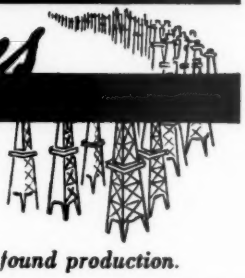
current oil field operations



Exploration wells that have found production.

▸ **Florida.** Humble 1-C Gulf Coast Realty C NE SW 21-47s-28e Collier. DST 660 ft 20.4° oil lower Cretaceous 11,918-38 ft.

▸ **Illinois.** Johnston Drlg. 1 Mathis SE NE NW 17-9-10 Gallatin. 368 BOPD McClosky 3047-53 and 3058-67 ft.

W. W. Toler Drlg. 1 Fornoff SE NE SW 28-2n-13w Lawrence. Oil from Benoist 2521-30 ft.

Wm. F. McGill 1 R. R. Kelly NW SE 20-3n-12w Lawrence. Oil from Benoist 1959-65 ft and 1970-80 ft.

R. P. Johnson & H. M. Williams Drlg. 1 J. Von Almen 31-5n-9s Richland. 1724 BOPD McClosky 2997-3006 ft.

J. L. Black 1 Kocher SE NW SW 2-4n-14w Richland. 100 BOPD Rosiclare 2930-36 ft.

Collins Bros. 1 Ollie Sever SE NW NE 12-2s-3e. Swb 175 B oil in 11-hr McCloskey 2896-901 ft.

Collins Bros. 1 A. J. Messman N½ NW NW 33-1s-9e Wayne. Swb 140 B oil in 8-hr McClosky 3300-06 ft.

▸ **Louisiana.** Superior B-5 Miami Corp. 30-14s-2w Pecan Lake field, Cameron. 4580 MCF gas and 48.3° cond from 10,805-17 ft. 65 B 45.6° cond and 5540 MCF gas daily 10,650-64 ft. New sands.

Magnolia 1 E-1 Doornbos-McPherson, Beauregard. 124 BOPD 48.6° from 8177 ft.

Texas C-1 State, lse 1246 Terrebonne. 78 B cond daily 13,718-40 ft.

Kerr-McGee 1 Frost Lbr, De Soto. 4000 MCF gas lower Pettit 6214-24 ft.

▸ **California.** Barnsdall 1 Fred Smith, 34-20s-16e Guijarral Hills, Fresno. 827 BOPD from Oligocene 8730 ft.

▸ **Wyoming.** Phillips 1 Cole Creek 17-34n-76w Converse. 346 BOPD 35.2° Lakota 8300 ft.

Seaboard 37-28, near Elk Basin, Park. 514 BOPD 46° from Embar.

Clark Drlg. 1 Wexal 19-46n-64w, Fiddler Creek, Weston. 30-min DST 600 ft oil Newcastle 4548 ft.

▸ **Mississippi.** H. W. Elliott 1 Ed. Ogden SW NE 42-6n-2w Adams. 260 BOPD 42° Wilcox 6409-27 ft.

▸ **Kansas.** Nadel & Gussman and Peel Drlg. 1 Fischer NE NE NW 36-21-13w Strafford. 3000 BOPD Arbuckle.

J. M. Huber 1 Haynes NE NE SE 13-26-12w Pratt. 80 BOPD Stark lime.

F. Monroe 1 Lueker NE NE NW 10-18-4e Marion. Oil from Mississippi Chat.

Derby and Aylward's Prod. 1 Marcotte SE SE SW 18-9-19w Rooks. Swb 35 B oil from Lansing.

Bay & Anderson-Prichard 1-B State SE SE SW 17-18-1w McPherson. 41 BOPD Chat 2829-34 ft.

G. Hess & W. J. Weber 1 Martha Bryan NW SE 23-19-1w McPherson. 3017 MCF gas daily Chat 2920-27 ft.

Carter 1 Mamie Strahn SW SW NW 27-2s-14e Nemaha. 38 B 22° oil in 9-hr. Hunton 2877-79 ft.

▸ **Oklahoma.** Superior 1 Long, Kingfisher. 20-min. DST 60° cond and 4-5000 MCF gas daily Hunton 8052-78 ft.

Phillips 1 Nesbitt SE SE NW 34-3n-3w Garvin. 270 B oil in 11-hr from 8139-50 ft.

Mid-Continent 1 Harman NW SE SE 33-13n-10e Okfuskee. 50 B oil in 8-hr from 2958-72 ft.

Carter 1 Yeary-Vaughn CSE NW 9-1n-1w Garvin. DST cond and 1400 MCF gas daily 4731-32 ft.

Deardorf 1 Joanne, Calvin blk, Hughes. 55 BOPH Simpson dolomite.

Cities Service 1 Street, Garvin. 490 B oil in 18-hr from 10,105-290 ft.

Mohawk Drlg. 1 Marshal SE SE SE 14-17n-1e Logan. 50 B oil and 1000 MCF gas daily Skinner 4490-510 ft.

▸ **Utah.** California Company well Garfield. 200 BOPD 17° Pennsylvania 8777 ft.

Equity 1 Ashley Unit Meagher SW SW 23-5s-22e Uintah. 155 BOPD Weber 4142-52 ft.

▸ **Texas.** D. M. Ross 1 Ellis, J. Couch sur, Wise. 8 BOPD Strawn 3999-4025 ft.

S. Grisham 2 Belle Wisdom, J. Ostane sur, Archer. 55 BOPD from 1168-75 ft.

Sunray 1 Davenport-State, Starr. 192 BOPD 48° Frio 4297-303 ft.

E. J. McCurdy 1 Pittman and Reynolds 2-11-T&P Shackelford. 40 BOPH Ellenburger 4533-38 ft.

Republic Natural 1-A Barnett 40-Y-TC Upton. 20 BOPH 59° Silurian 11,242-310 ft.

Star 2-A Ross, W. Walker sur A-793, Ross field, Clay. 85 BOPD 42° from 5616-35 ft. New sand.

Texas 1 Fannie Merritt 44-18-T&P Jones. 42 B oil in 10-hr Strawn 4635-50 ft.

Delta Drlg. 1 Max Rice, O. Anderson sur, Smith. 5.4 BOPH Paluxy 7572-608 ft.

Wilshire 1 McElroy 148-E-CCSD&RGNG Upton. 210 B oil in 6-hr Wolfcamp 7882-980 ft.

Cities Service 1 Brunson, Crane. 160 B oil in 3-hr from 5783-856 ft.

Hiawatha 2 F. Vaello, Duval. 85 BOPD from 8460-65 ft.

Texas 1 Foster, Jim Wells. 11,800 MCF gas daily from 4460-70 ft.

Quintana 1 Willit Wilson, Calhoun. 36,000 MCF gas daily from 8834-40 ft.

T. F. Hunter 1 T. B. Wilson, S. P. Ellis sur, Archer. 204 BOPD Mississippi 4988-36 ft.

Carl Casey and S. O. Weempe 1-A O. G. Rogers, Wm. Greenwood sur, Anderson. 79,000 MCF gas daily and 514 B cond Woodbine 5379-88 ft.

L. Smith & M. Donking 1 J. C. Allen, Wharton, 171 BOPD 46° from 7189-91 ft.

A. P. Groebl & V. J. Powell 1-A J. C. Beddo, D. Diaz sur 532 Runnels. 128 B oil in 12-hr Gardner 3817-37 ft.

Signal and T. W. & J. M. Loffland, Jr. 1 Daly, blk 48, J. F. Williamson sur, Wise. 5000 MCF gas and 216 B cond daily Ellenburger 6505-65 ft.

Geier-Jackson 1 Southern Pine Lbr., T. N. Jones sur. Cherokee. 219 BOPD 25° Woodbine.

Davis. Johnson & Davis 1-A Stephens HT&B sur, Brown. 2500 MCF gas daily 1122 ft.

Fresno 1 J. M. Morisett, sec 67, blk 14, TPRR Callahan 62 BOPD 1716 ft.

Texas Pacific 1-F University Shafter Lake field, Andrews. Oil DST Clear Fork 6823-900 ft. New sand.

Honolulu 11-B Slaughter, Cochran. 75 BOPD from 5088-105 ft.

A. D. Adams & Assoc. 1 Lula A. Holcomb, D. McLean sur, Houston. 111 BOPD 25° Woodbine 5756-68 ft.

Honolulu 1-13 B Elwood Estate, Thompson sur, Hockley. 243 BOPD from 5855-987 ft.

▸ **Indiana.** George & Wrather Drlg. 1 W. Reiman SW SE SW 30-4s-11w Vanderburgh. DST 720 ft oil Cypress 2620 ft.

THE Petroleum Engineer
OCTOBER, 1948

Foreign Number

U. S. Companies Expand Foreign Operations

By H. J. STRUTH, *Editor, The Petroleum Data Book*

INTENSE interest of American oil companies in global petroleum developments has greatly expanded investments of capital in foreign properties, plants, and equipment. Today, as a result of increasingly active participation in foreign petroleum developments, American interests own and control about 79½ per cent of the world's oil industry.

A survey just completed by *The Petroleum Data Book*, for its second annual edition, indicates that American interests own nearly 36 per cent of all petroleum industry facilities outside of the United States. These holdings have, as a result, greatly augmented the supplies of petroleum and its products that are presently available within the United States and are providing supplemental supply sources that might otherwise have to be taken from domestic supplies in the form of exports to other nations.

While the United States has long led the rest of the world in petroleum production and physical facilities for the manufacture of refined products, the expansion of capital investments in petroleum properties of many other nations and the injection of American experience and enterprise into the development of foreign petroleum resources has greatly augmented the world's future supply of petroleum and its products. Not only have Americans led the way in developing petroleum resources of other nations, as well as their own, but by their willingness to risk huge investments in foreign developments, they are bringing new wealth and new jobs to the people of other nations and are contributing to the building of a more stabilized world-wide petroleum industry.

American interests are at present active in drilling, producing, refining, and marketing petroleum and its products in 20 foreign countries. In 1947, U. S. oilmen drilled 33.6 per cent of all the wells completed in all foreign countries. This accounted for a total of 1255 wells and comprised a total footage drilled of 4,392,000 feet of hole. A check of production facilities owned by American interests in other nations shows that 38 per cent of all the producing wells outside of the United States are American owned. At the close of 1947, a total of 17,348 producing oil wells in other countries were operated by American interests. These do not include several hundred more that were originally drilled and owned by Americans, but that have been confiscated by Communistic foreign governments. This applies, likewise, to refining properties and pipe lines in Russian-controlled nations.

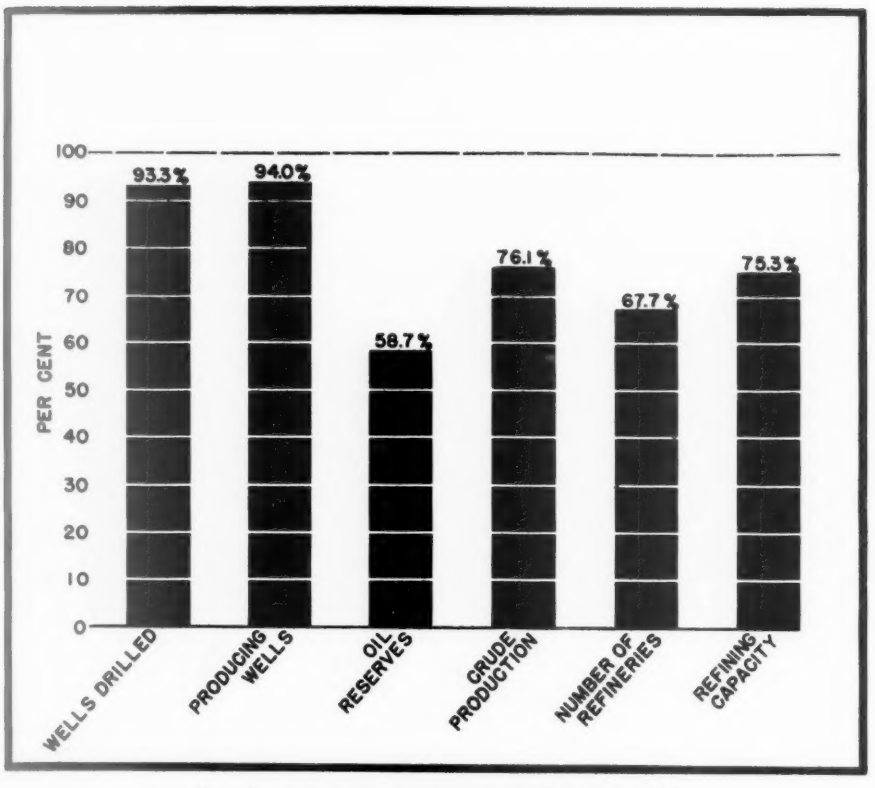
U. S. crude oil production in 1947 averaged 5,085,000 bbl daily, but foreign ownership added 1,216,456 bbl daily to the domestic total and credited the United States with producing 76.1 per cent of the world's total crude output. The facts indicate that American interests own 38 per cent of all the oil produced from oil fields located outside of the United States. Through direct ownership and through the operation of foreign concessions that are being developed with American capital, the quantity of proved petroleum reserves credited to the United States comprises 58.7 per cent of the world's total. This means that American interests control a total of 42,542,000,000 bbl of oil reserves in the world, of which 58.2 per cent are in the United States and 41.8 per cent are in other parts of the world. Our proved oil reserves at the close of 1947, including natural gas liquids, aggre-

World ownership of petroleum industry—owned by American interests.

	Owned by American interests					American interests, per cent of world	Owned by by other nations	Other nations, per cent of world	World totals	Totals outside U. S.	Per cent American interests	Per cent foreign interests
	In U. S.	Per cent	Outside of U. S.	Per cent	Total							
Wells drilled (1947)	33,290*	96.3	1,255	3.7	34,545	93.3	2,484	6.7	37,029	3,739	33.6	66.4
Footage drilled (1947) (thousands)	114,219	96.3	4,392	3.7	118,611	93.2	8,694	6.8	127,305	13,086	33.6	66.4
Producing wells (12-31-47)	429,336	96.1	17,348	3.9	446,714	94.0	28,283	6.0	474,997	45,631	38.0	62.0
Oil reserves (12-31-47) (thousands)	24,742,000†	58.2	17,800,000	41.8	42,542,000	58.7	29,972,000	41.3	72,514,000	47,772,000	37.3	62.7
Daily crude oil production (1947)	5,085,000	80.7	1,216,456	19.3	6,301,456	76.1	1,981,544	23.9	8,283,000	3,198,000	38.0	62.0
Number oil refineries 1-1-48	366	90.1	40	9.9	406	67.7	194	33.3	600	234	17.1	82.9
Daily crude capacity 1-1-48	5,926,085	84.0	1,132,358	16.0	7,058,443	75.3	2,313,805	24.7	9,372,248	3,446,163	32.9	67.1

*Includes 2264 service wells drilled in U. S.

†Includes 3,254,000,000 bbl of natural gas liquids reserves in U. S.



American interests own approximately 79.5 per cent of the world's petroleum industry.

gated 24,742,000,000 bbl, but we also have, through foreign ownership, an additional back-log of reserves in the order of 17,800,000,000 bbl.

The world has produced since 1857 about 43 per cent of all the oil found and proved to be recoverable to date. Cumulative production of the world to date has been in the order of 54,824,263,000 bbl. Cumulative production of the United States, exclusive of foreign-owned production, has amounted to 35,082,509,000 bbl. The United States has produced to date 58.6 per cent of her known reserves, while the rest of the world has produced only 29.2 per cent of all the oil accounted for. These facts make it evident that many opportunities exist in foreign countries for the development of oil producing properties. Developments in South America and the Middle East have provided the world with substantial proof of capital and social gains that have accrued to other nationals through the development of petroleum resources by American interests. Other nations have recognized the benefits made possible by American free enterprise and many have opened the way to American companies to explore and develop oil producing possibilities.

Of far-reaching importance to the United States at this time, is the world-wide ownership of refining facilities by American interests. At the close of 1947, a check of American owned plants in foreign nations revealed a total of 40 modern refineries, with a total daily crude oil capacity of 1,132,358 bbl. The facts show that 16 per cent of the refining capacity owned by American interests is in foreign countries. The U. S. oil industry owns and controls at present about 75.3 per cent of the world's crude oil refining capacity, which includes nearly one-third of all the capacity outside of the continental U. S. American interests were credited at the close of 1947 with a total refining capacity of 7,058,443 bbl daily. The world's refining capacity is about 9,372,248 bbl daily.

Analysis of crude oil production in foreign countries shows that American interests own 56.4 per cent of the oil produced in the Western Hemisphere, outside of the U. S.; 37.6 per cent of the production in the Near East and Middle East; 4.5 per cent of that produced in the Far East and only 0.4 per cent of European production. Combined interests of American, British, and Dutch companies are credited with about 72 per cent of all the oil produced outside of the United States. The Russian government controls less than 8 per cent of the world's oil production. Her total output in 1947 was about 544,000 bbl daily, and may currently be as much as 571,000 bbl daily. Even by including the production of her satellites, Russia can lay claim to only 650,000 bbl daily. Production by American interests in 1947 was 6,301,456 bbl daily, or 76.1 per cent.

The extent to which American interests have entered foreign fields in recent years is shown by comparing figures of pre-war years with those of 1947. In 1938, American interests

Crude oil production in foreign countries by major nationalities.
(Barrels daily)

1938	Western Hemisphere	Per cent of area	Europe and Africa	Per cent of area	Near and Middle East	Per cent of area	Far East	Per cent of area	Total Foreign	Per cent of area
American Companies	402,520	47.5	20,142	2.7	43,800	13.4	40,516	19.4	506,978	23.8
British-Dutch Companies	343,912	40.6	51,203	6.9	262,329	80.3	152,607	72.9	810,051	38.1
Other companies	101,004	11.9	94,437	12.7	20,588	6.3	9,750	4.7	225,779	10.6
Sub-total	847,436	100.0	165,782	22.3	326,717	100.0	202,873	97.0	1,542,808	72.5
Russian Government	..	..	579,597	77.7	..	..	6,372	3.0	585,969	27.5
Total foreign	847,436	100.0	745,379	100.0	326,717	100.0	209,245	100.0	2,128,777	100.0
Per cent of total foreign	39.8		35.0		15.4		9.8		100.0	
1941										
American companies	512,533	51.8	23,319	2.9	34,064	17.0	40,724	20.2	610,640	27.7
British-Dutch companies	321,480	32.5	23,968	2.9	166,738	83.0	143,885	71.5	656,071	29.7
Other companies	154,829	15.7	134,324	16.4	..	..	7,284	3.6	296,437	13.4
Sub-total	988,842	100.0	181,611	22.2	200,802	100.0	191,893	95.3	1,563,148	70.8
Russian Government	..	..	635,000	77.8	..	..	9,465	4.7	644,465	29.2
Total foreign	988,842	100.0	816,611	100.0	200,802	100.0	201,358	100.0	2,207,613	100.0
Per cent of total foreign	44.8		37.0		9.1		9.1		100.0	
1946										
American companies	832,675	58.1	1,386	.2	212,953	30.4	..	..	1,047,014	37.7
British-Dutch companies	423,244	29.5	26,883	4.4	464,471	66.3	19,500	55.4	934,098	33.6
Other companies	178,112	12.4	134,187	22.1	22,851	3.3	5,677	16.2	340,827	12.3
Sub-total	1,434,031	100.0	162,456	26.7	700,275	100.0	25,177	71.6	2,321,939	83.6
Russian Government	..	..	447,060	73.3	..	..	10,000	28.4	457,060	16.4
Total foreign	1,434,031	100.0	609,516	100.0	700,275	100.0	35,177	100.0	2,778,999	100.0
Per cent of total foreign	51.6		21.9		25.2		1.3		100.0	
1947(P)										
American companies	897,476	56.4	2,873	.4	312,607	37.6	3,500	4.5	1,216,456	38.2
British-Dutch companies	492,646	30.9	28,954	4.2	496,407	59.7	59,187	76.6	1,077,194	33.8
Other companies	201,705	12.7	122,324	17.8	22,305	2.7	4,600	6.0	350,934	11.0
Sub-total	1,591,827	100.0	154,151	22.4	831,319	100.0	67,287	87.1	2,644,584	83.0
Russian Government	..	..	533,000	77.6	..	..	10,000	12.9	543,000	17.0
Total foreign	1,591,827	100.0	687,151	100.0	831,319	100.0	77,287	100.0	3,187,584	100.0
Per cent of total foreign	49.9		21.6		26.1		2.4		100.0	

Source: "Extent and Relative Position of American Oil Interests in Foreign Countries," Volume One of reports submitted to the O'Mahoney Senate Committee Investigating Petroleum Resources. Revised and brought up-to-date by the Coordination and Economics Department, Standard Oil Company (New Jersey).

(P)–Preliminary.

Part of a detailed annual study printed in *The Petroleum Data Book*, Second Edition.

World petroleum balance sheet, 1947.
(Thousands of barrels daily)

	Crude oil production	Nat gaso, benzol, synthetics, etc	Total production	Imports from other major areas	Total supply	Stock change‡	Domestic consumption	Exports to other major areas	Total demand
United States*	5,085.2	363.5	5,448.7	437.3†	5,886.0	—13.8	5,449.2	450.6†	5,899.8
North America	5,260.9	365.9	5,626.8	553.5	6,180.3	—13.8	5,965.2	228.9	6,194.1
South America	1,417.4	8.9	1,426.3	19.7	1,446.0	..	430.3	1,015.7	1,446.0
Western Europe	33.2	6.0	39.2	768.1	807.3	—20.3	820.6	7.0	827.6
Eastern Europe	95.0	16.2	111.2	24.3	135.5	..	99.0	36.5	135.5
Africa	25.5	0	25.5	142.9	168.4	..	168.4	0	168.4
Middle East	840.3	0	840.3	2.0	842.3	..	160.0	682.3	842.3
East Asia	11.2	0	11.2	198.4	209.6	..	209.1	0.5	209.6
Oceania	56.1	0	56.1	93.9	150.0	..	146.0	4.0	150.0
U.S.S.R. (incl Sakalin)	543.0	1	544.0	42.6	586.6	..	581.1	5.5	586.6
Undistributed (military)				135.0	135.0		135.0		135.0
World total	8,282.6	398.0	8,680.6	1,980.4	..	—34.1	8,714.7	1,980.4	..

*Shown for comparison. †Including exports to and imports from other North American countries.
‡Not available for countries other than United States and United Kingdom.
Reprinted from *The Petroleum Data Book*, Second Edition.

owned 23.8 per cent of the oil produced outside of the United States, compared with 38.2 per cent in 1947. Pre-war production of American interests in the Western Hemisphere, outside of the U. S., amounted to 47.5 per cent, compared with 56.4 per cent in 1947. In the Middle East, Americans own 37.6 per cent of the oil output, compared with only 13.4 per cent in 1938. European and Far Eastern production by Americans has shown a substantial decline since 1938, due to losses sustained during the war, and more lately to unfavorable political actions by communistic governments.

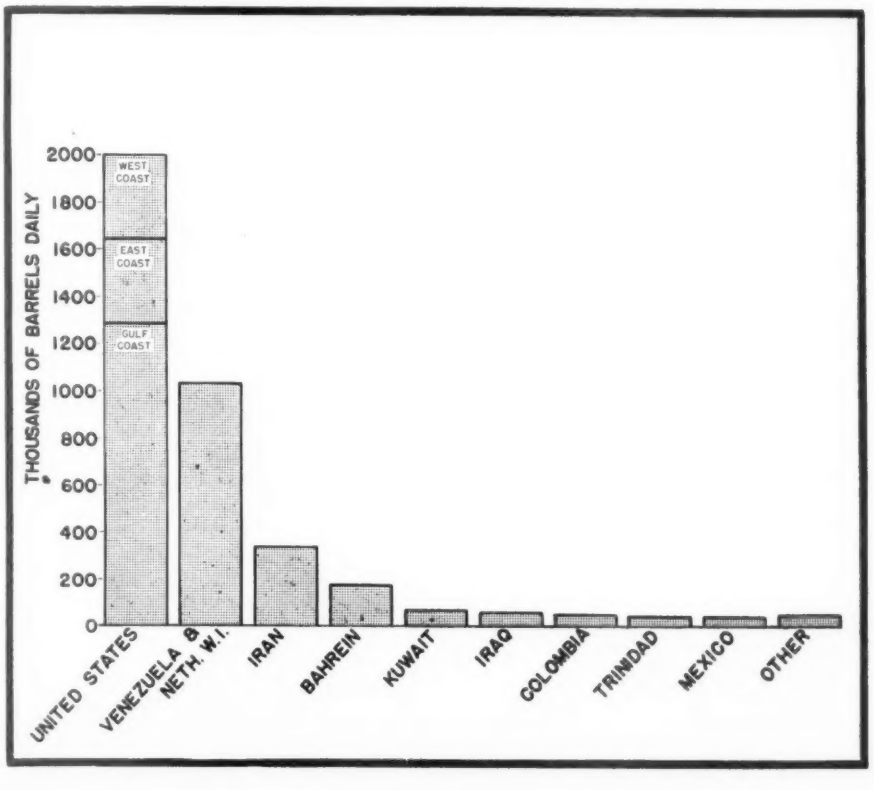
The world's supply of all oil in 1947 amounted to 8,680,600 bbl daily, while the combined demand of all nations was 8,714,700 bbl daily. Need for more oil throughout the world spurred the search for new sources of supply and prompted greatly increased exploration and drilling activities in many countries outside of the United States. Data obtained from several international operating companies and foreign governments indicated that the world's oil reserves were increased last year by a total of about 2,700,000,000 bbl. Additions to reserves in the Middle East amounted to 1,500,000,000 bbl; South American countries increased their reserves by about 600,000,000 bbl and the United States increased reserves to the extent of about 705,000,000 bbl. Best available information indicates that Russia, Europe, and the Far East used oil at a greater rate than new discoveries, and reserves of these areas were apparently depleted to the extent of about 66,000,000 bbl.

The combined volume of petroleum and it products moved in international trade and between intercoastal ports during 1947 amounted to a daily average of 3,818,600 bbl. U. S. interport and export movements comprised over 52 per cent of the total world volume moved last year. The volumes moved by the U. S. in 1947 combined to a total daily average of about 2,000,000 bbl. Venezuela and Netherlands West Indies movements combined to a daily average of 1,026,700 bbl, being second to that moved by the United States. Movements out of the U. S. Gulf Coast constituted the largest in the world during 1947, with a daily volume of 1,285,000 bbl. Imports of the United States from South America and Mexico comprised about 42 per cent of the total exports of these areas.

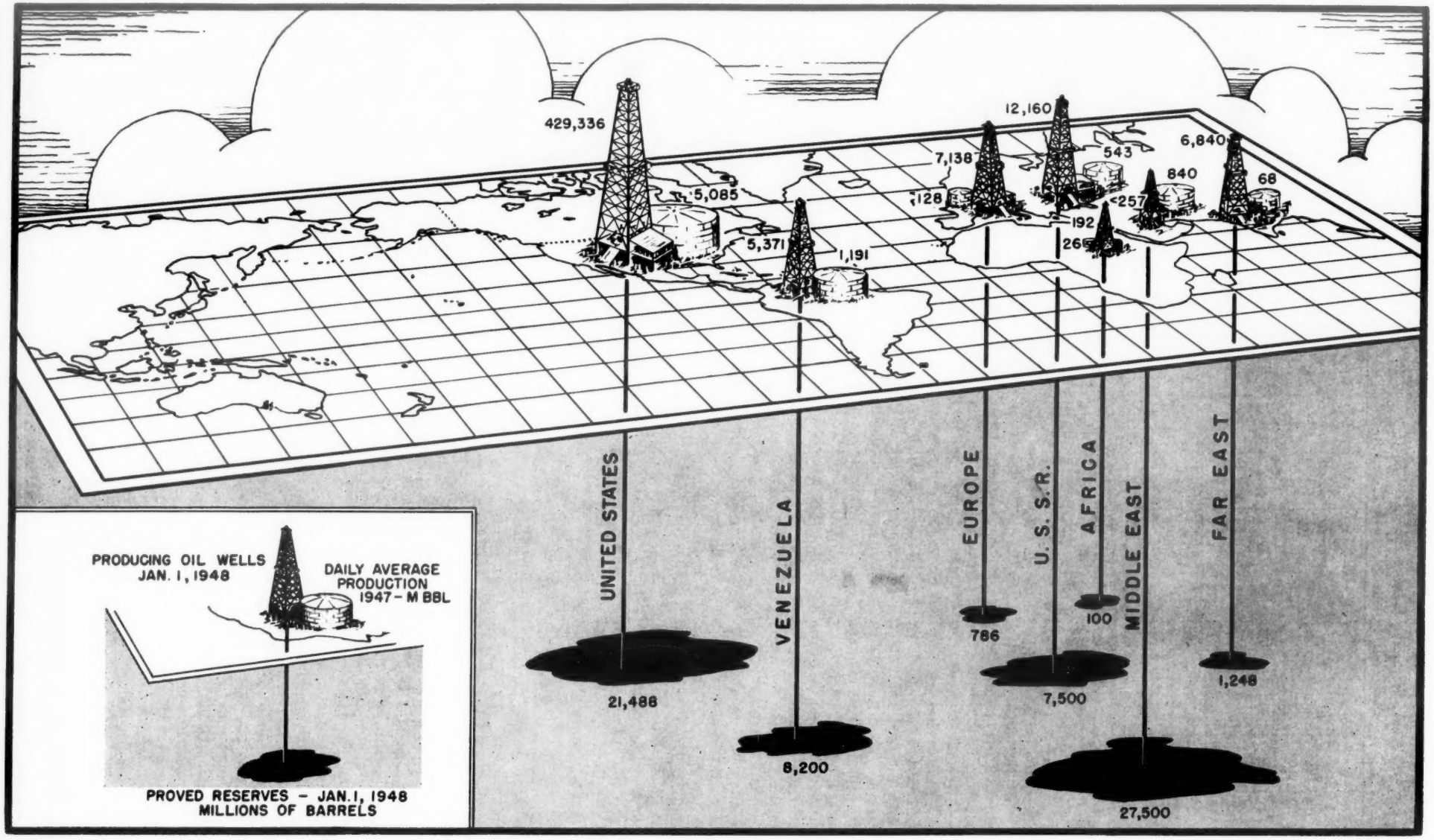
Most of the oil exported from the Middle East moves to Europe, Africa, and the Far East. Very little of this oil has thus far been imported by the U. S., except that purchased by U. S. military contracts. Although the bulk of the oil produced in the Middle East is owned by American interests, it has been found expedient to move it into foreign trade channels. This serves to supplement supplies in the United States by reducing export volumes that would otherwise be supplied out of domestic production. It is fortunate, in view of the constantly increasing demand for petroleum products in the United States, that continually greater volumes of oil are becoming available in the Middle East. Expansion of refining and pipe line facilities in that area are also contributing more and more to relieve U. S. producers and refiners of the pressure to supply the growing demand for products in other parts of the world.

The largest known oil reserves in the world are in the Middle East, which contains 39.7 per cent of the world's oil reserves and produces but 10.2 per cent of the world's crude oil. Reappraisal of Middle East reserves at the close of 1947 placed the combined total of this area at 27,500,000,000 bbl. This compares with new estimates of crude oil reserves in the United States, excluding natural gas liquids, of 21,438,000,000 bbl. Over 10,000,000,000 bbl of the Middle East reserves total are owned by American oil interests. Venezuela's reserves, in which U. S. oilmen also have a substan-

World Oil Movements averaged 3,818,600 bbl daily in 1947, of which U. S. movements comprised over 52 per cent. (Includes intercoastal and export volumes.)



WORLD PANORAMA OF WELLS, PRODUCTION, AND RESERVES



United States, Venezuela and the Middle East possess 82.5 per cent of world's oil reserves

—Reprinted from The Petroleum Data Book, Second Edition.

tial interest, are estimated at a total of 8,200,000,000 bbl. Reserves of the Western Hemisphere are placed at a total of 32,125,000,000 bbl, or about 46 per cent of the world total. The United States, Venezuela, and the Middle East possess 82.5 per cent of the world's reserves.

Kuwait reports the largest reserves per producing well in the world. With 13 producing wells in operation and reserves of 9,000,000,000 bbl, the average reserves per well amount to 692,307,600 bbl. This compares with an average per well in the United States of only 50,000 bbl. The Kuwait figure will obviously be reduced as more wells are completed, but the inference is startling, particularly in the light of an average daily production per well of 4,190 bbl. The largest daily rate of production per well is found in Iran, where 63 wells each average 6,961 bbl daily. By comparison, the daily average production per well in the United States is only about 12 bbl.

Expansion of the world's petroleum industry has been phenomenal over the last few years, and with more active participation of American interests in many foreign countries there is every reason to believe that the pace set since the end of World War II will continue over many years to come. Projections of petroleum industry expenditures over the next five years, ending with 1953, compiled by Joseph E. Pogue, Vice President of the Chase National Bank, indicate combined capital investments of nearly $13,000,000,000, and a substantial share of this money will be supplied by American interests. Expenditures in the Middle East and in South America, largely by American interests, are expected to total $2,850,000,000. U. S. expenditures over the next five years, according to this authority, are placed at $7,500,000,000 or 57 per cent of the world total. Expeditures in Europe (except Russia) are placed at $1,275,000,000.

Greater interest is being manifested also in an expanded petroleum industry in Mexico. Recent reports indicate that substantial amounts of American capital are being made available for exploration work in that country. Several large American oil companies have made deals with the Mexican Government to loan capital to Pemex for the privilege, in return, of purchasing Mexican oil production. Mexican oil fields have been on the decline for some years and there is an urgent need for new exploratory work and some new oil fields in that country. Mexico has been importing petroleum products from the United States in the volume of about 9,000 bbl daily, and has in return been shipping about

World oil tanker movements, 1947.
Excludes military and Russian movements (daily average—barrels).

	Barrels
From U. S. Gulf and East Coast	
To: U. S. East Coast	1,385,000
Mexico	3,000
Canada	23,000
Puerto Rico	8,000
Central America, Cuba, Caribbean	19,000
South America	16,000
West Europe	165,000
East Europe	1,500
Africa	10,000
Middle East	1,500
East Asia	8,000
Oceania	5,000
Total	1,645,000
U. S. East Coast (including above)	360,000
Net U. S. Gulf movements	1,285,000
From U. S. West Coast	
To: Intra—West Coast	250,000
U. S. East Coast	2,500
Canada	37,000
Mexico	6,000
Alaska—Hawaii	27,000
Russia	2,000
East Asia	11,000
Oceania	20,000
Total	355,500
From Mexico	
To: United States	27,000
Canada	500
Cuba—Caribbean	4,000
West Europe	3,500
Total	35,000
From Colombia	
To: U. S. East Coast	33,000
Canada	5,500
West Europe	1,000
Other South America and Netherlands West Indies	6,000
Total	45,500
From Ecuador	
To: Other South America	2,700
From Peru	
To: East Europe	2,000
Central America	1,500
Oceania	500
Other South America	10,300
Total	14,300
From Trinidad	
To: United States	1,500
Canada	2,500
West Europe	20,000
Africa	3,000
Other South America and Caribbean	14,000
Total	41,000

	Barrels
From Venezuela and Netherlands West Indies	
To: United States	371,500
Other North America (Caribbean)	55,500
Canada	74,000
West Europe	358,700
East Europe	3,000
Africa	35,000
Middle East	500
Oceania	2,500
Other South America and Caribbean	126,000
Total	1,026,700
From Iran	
To: West Europe	124,700
Greece	5,000
Africa	41,100
East Asia	118,200
Oceania	49,500
Total	338,500
From Iraq	
To: West Europe	33,900
East Europe	5,300
Africa	10,000
Turkey	3,200
Total	52,400
From Kuwait	
To: West Europe	43,000
Greece	3,000
Africa	4,000
East Asia	10,000
Other Middle East	3,000
Total	63,000
From Bahrein—Ras Tanura	
To: West Europe	52,000
South America	3,000
Africa	44,800
East Asia	47,000
Oceania	20,000
Other Middle East	4,200
Total	171,000
From Burma	
To: West Europe	500
From British Borneo	
To: Oceania	20,000
From Netherlands East Indies	
To: West Europe	500
Oceania	5,000
East Asia	2,000
Total	7,500
Grand total	3,818,600

Source: Summary of a more detailed study of World Oil Tanker Movements compiled by Shirley Haile, Economics Department, Standard Oil Company of California.
Reprinted from *The Petroleum Data Book*, Second Edition.

World's oil reserves, production, and producing wells.
(Major geographical areas and selected countries)

	Producing oil wells (Jan. 1, 1948)	Proved reserves (million bbl) (Jan. 1, 1948)	Reserves per well (thousand bbl)	Production, 1947 (thousand bbl daily)	Production per well (bbl daily)	Per cent of world		
						Wells	Reserves	Production
North America	432,438	22,710	52.5	5,261	12.2	91.04	32.8	63.5
United States	429,336	21,488*	50.0	5,085	11.9	90.39	31.0	61.4
South America	15,972	9,415	589.5	1,417	89.4	3.36	13.6	17.1
Venezuela	5,371	8,200	1,526.7	1,191	231.4	1.13	11.8	14.4
Europe	7,138	786	115.7	128	17.8	1.50	1.1	1.5
U. S. S. R. (incl Sakalin)	12,160	7,500	616.7	543	45.4	2.56	10.8	6.6
Africa	192	100	512.8	26	134.4	0.04	0.1	0.3
Middle East	257	27,500	107,003.9	840	3,750.0	0.05	39.7	10.2
Iran	63	7,000	111,111.1	425	6,961.0	0.01	10.1	5.1
Iraq	23	5,000	217,391.3	99	4,829.3	°	7.2	1.2
Kuwait	13	9,000	692,307.6	44	4,190.5	°	13.0	0.5
Saudi Arabia, Bahrein Is. & Qatar	158	6,500	41,139.2	272	2,068.4	0.03	9.4	3.3
Far East	6,840	1,248	182.5	68	10.0	1.44	1.8	0.8
World totals	474,997	69,260	146.0	8,283	17.7	100.0	100.0	100.0

*Crude oil only; other liquid hydrocarbons amount to approximately 3,254 million barrels.
°Negligible.
Source: *The Petroleum Data Book* Research Department.

27,000 bbl daily of crude to the United States.

Since 1938 the world demand for petroleum and its products has increased 3,083,000 bbl daily, or about 55 per cent. In 1938, the world demand was 5,632,000 bbl daily; in 1947 the daily average was 8,715,000 bbl. U. S. demand for petroleum during this period increased nearly 75 per cent and that of the rest of the world increased about 30 per cent. The year 1947 brought the largest increases in demand ever experienced by the petroleum industry. U. S. domestic requirements increased 542,000 bbl daily over 1946, while demand of all other nations showed an increase of 373,000 bbl daily.

With higher prices for oil and the realization that the entire world is clamoring for more petroleum products, the year 1947 witnessed the greatest drilling campaign in the history of the world's oil industry. Drilling operations in over 50 countries outside of the United States resulted in the completion of 3,739 wells. Russia is estimated to have drilled about 875 wells in the U.S.S.R. and about 10 wells in Sakhalin. Venezuela was second in drilling activity outside of the U. S., with 787 completions.

Domestic requirements of major world areas, 1947 (barrels daily).

United States	5,449,200
Canada	262,700
Mexico	132,300
Non-contiguous	40,000
Other North America	81,000
Total North America	5,965,200
Argentina	135,900
Netherlands West Indies	105,800
Brazil	50,000
Venezuela	30,000
Other South America	*153,600
Total South America	475,300
United Kingdom	301,400
France	135,000
Italy	70,000
Sweden	55,000
Netherlands	50,900
Other Western Europe	*198,300
Total Western Europe	820,600
U. S. R. R.	581,100
Rumania	38,500
East Germany (U. S. S. R.)	15,000
Greece	14,000
Other Eastern Europe	31,500
Total Eastern Europe	99,000
Iran	51,000
Arabia-Bahrein	35,000
Palestine	30,000
Other Middle East	*134,000
Total Middle East	250,000
Africa	168,400
China	90,000
India	59,100
Other Eastern Asia	60,000
Total Eastern Asia	209,100
Australia	60,000
Other Oceania	86,000
Total Oceania	146,000

*Includes military demand.

Reprinted in part from *The Petroleum Data Book*, Second Edition.

Estimates of petroleum reserves in principal producing countries, January 1, 1948

Country	Estimated reserves Jan. 1, 1948 (million bbl)	Per cent world reserves	Per cent world prod 1947
North America:			
United States	21,488*	31.0	61.4
Mexico	1,050	1.5	1.9
Canada	169	0.2	0.2
Cuba	3	○	○
Total	22,710	32.8	63.5
South America:			
Venezuela	8,200	11.8	14.4
Colombia	500	0.7	0.8
Argentina	250	0.4	0.7
Trinidad	225	0.3	0.7
Peru	164	0.2	0.4
Bolivia	50	0.1	○
Ecuador	25	○	0.1
Brazil	1	○	○
Total	9,415	13.6	17.1
Far East:			
Netherlands East Indies	840	1.2	0.2
Sarawak and Brunei	210	0.3	0.4
Burma	110	0.2	○
Pakistan and India	33	○	0.1
Japan	32	○	○
China (incl Formosa)	23	○	○
	1248	1.8	0.8
Middle East)			
Iran	7,000	10.1	5.1
Iraq	5,000	7.2	1.2
Saudi Arabia (incl Bahrein and Qatar)	6,500	9.4	3.3
Kuwait	9,000	13.0	0.5
Total	27,500	39.7	10.2
Europe (excl U. S. S. R.)			
Rumania	480	0.7	0.9
Germany	80	0.1	0.1
Hungary	70	0.1	0.1
Austria	69	0.1	0.2
Poland	20	○	○
Albania	25	○	○
Netherlands	20	○	○
England	8	○	○
France	9	○	○
Czechoslovakia	3	○	○
Italy	1	○	○
Yugoslavia	1	○	○
Total	786	1.1	1.5
U.S.S.R. (incl Sakhalin)	7,500	10.8	6.6
Other countries:			
Egypt	100	0.1	0.3
Undistributed	1	○	○
World totals	69,260	100.0	100.0

○Negligible.

*Crude oil only; other liquid hydrocarbons amount to approximately 3,254 million barrels.

Source: U. S. from American Petroleum Institute; others from private sources.

Reprinted from *The Petroleum Data Book*, Second Edition.

Canadian drilling operations were greatly revived by the discovery of the new Leduc field, with estimated reserves of about 100,000,000 bbl. About 630 wells were drilled in Canada last year and 35 were brought in as producers in the Leduc area.

The province of Alberta is believed to contain many potentially large oil structures and the Leduc discovery is reported to have launched a wave of new exploratory activity in several promising areas. Revival of interest in Canadian oil producing possibilities is being spurred by the belief that Canada may ultimately be able to produce all her oil requirements from domestic sources and may not have to depend upon South American and

Total foreign wells drilled by countries, 1947.

Argentina	195
Australia	0
Austria	1
Bahama Islands	1
Bahrein Island	6
Bolivia	6
Brazil	27
Canada	630
Chile	6
Colombia	133
Cuba	4
Denmark	2
Ecuador	3
England	5
Egypt	12
France	29
Germany	90
Hungary	20
India and Burma	10
Iran	5
Iraq	8
Italy	20
Japan	52
Java	38
Kuwait	5
Mexico	50
Netherlands	17
Panama	1
Paraguay	5
Peru	142
Poland	90
Qatar	1
Rumania	65
Russia	875
Sakhalin	10
Sarawak	15
Saudi Arabia	22
Spain	3
South Africa	2
Sweden	1
Syria	3
Trinidad	126
Turkey	5
Venezuela	787
Yugoslavia	2
Others	209
Total	3739

Reprinted from *The Petroleum Data Book*, Second Edition.

United States oil for home needs. Here, again, American capital is playing an important part in the development of Canadian petroleum resources.

All over the world, except in Russia and her satellite nations, American oilmen have taken the lead in exploring for oil and developing new oil fields, new refineries, and new pipe lines. Through the activities of American oilmen in foreign lands, many people are learning the true meaning of democracy and free enterprise. Foreign governments, like Saudi Arabia and Venezuela, have found new wealth through tax levies on oil production and export shipments; new roads have been built; new schools and higher learning have been made available to thousands of persons who had never before known the luxury of education; new jobs at good wages for natives have greatly improved living standards in countries that have opened the way to American development of their petroleum resources. We hear a great deal today about the need for enlightenment of millions of suppressed people of the world to the American system of democracy and free enterprise. What better way could be found than through the development of petroleum resources by American representatives of the best system of government in the world?

* * *

Roundup of World Oil Activities

By ERNESTINE ADAMS, *Managing Editor*

EXCLUSIVE

THE world oil industry has been traveling over well worn trails and has sought out unknown places in its determination to outpace oil demand.

Collected below are events that show how far and how wide the earth has been covered by negotiators and scouts, by exploration parties and drilling crews, by designers and refinery engineers.

Results of this continued effort were showing up, too. For the first time the world ran over 3 billion bbl production in 1947, almost 1 billion more than in 1942. A billion increase in 5 years is quite an accomplishment. In 1948 world crude production for the first time ran to 9 million bbl a day and then passed that mark.

There were spots of oil scarcity but these were due more to political unrest than to the petroleum industry.

Indications from a resumé of world oil activities is that costs have increased in every part of the world, although, in general, not as much as in the United States. Because of high costs, former expropriation actions, and political conflict the main object of the industry is devoted to developing favorable concessions.

Private capital has to have more reliable assurance in contracts than some governments are willing or able to provide. On the other hand, governments that exploit their own resources are having trouble in getting appropriations to proceed on any large scale and, following that, difficulty in obtaining equipment and expert help.

Many governments cannot afford the high cost of exploration and drilling without immediate returns and an oil search is a distinct gamble even with all our scientific equipments.

The Arabian American Oil Company recalls its experience in the ancient land of Saudi Arabia. Geologists began work in 1933 and by the end of 1937 ten wells had been drilled without enough oil to write home about. Then in 1938, after five years of failure and $3,000,000 expenditure. came Damman No. 7 and the first field. Now production has passed 400,000 bbl daily. So far the cost has run about $150,000,000 and more expansion is planned.

Standard-Vacuum had even a longer period of effort before Sumatra had production. The concession was granted in 1912 and it was 10 years later, in 1922, before the first paying field was found.

A great deal of capital and even more patience are not often combined in government administrations so state oil monopolies frequently run into problems that delay development of oil resources.

Despite the buzz of activity in the four corners of the world there are yet great potentialities that are virtually untouched. Whatever may happen within political boundaries, the world is not running out of oil and real peace should see an ample supply to meet demand.

There is no attempt to be exhaustive in the following review of activities. The idea is to present an opportunity to catch up with progress of world oil development in various countries.

▸ **Alaska.** Reckless remarks in Congress about the U. S. Naval Reserve No. 4 being a petroleum bonanza are far from being proved. Core drilling and three test wells are the extent of activities on the 37,000-sq-mile government reserve. Exploration is carried on by De Golyer and Mac Naughton, and Arctic Contractors, whose owners include Hoover, Curtice and Ruby, both internationally known consulting firms. An appropriation of $14,600,000 was recommended for additional exploration in the North Alaska reserve. No commercial production as yet.

▸ **Albania.** Although no reports on this country seep through the iron curtain it is safe to assume production is not more than 1500 bbl a day, and exploration virtually at a standstill. The prospects here are too slim to receive scarce materials for development.

Acknowledgement

The information contained in this review of oil activities outside the United States is collected by courtesy of government administrations and companies operating in the various countries. We hereby express our thanks for their endeavor in helping to present an accurate picture of world oil affairs.

▸ **Algeria.** The National Company for Petroleum Research and Exploitation in Algeria (Societe Nationale de Recherche et d'Exploitation des Petroles en Algerie) has been conducting for the last 15 months extensive geological surveys over the 3 districts of Algeria. Drilling has also been started and is proceeding on an increasing scale mainly in the Cheliff Basin (Oran District) where two 7000-ft rigs (Unit Rig 15), two 4000-ft rigs (Massarenti), and a 2500-ft core drilling rig (Ideal) are operating.[1]

A small production, 75 bbl a month, comes from Tliouanet field, an old discovery.

▸ **Angola.** Exploration is being carried on in this Portuguese colony in southwestern Africa by Companhia dos Beluminosos de Angola, a private company.

▸ **Argentina.** Yacimientos Petroliferos Fiscales, government oil company has made drilling contracts with at least two American firms although oil concessions to foreign companies are now illegal. Glenn H. McCarthy, Houston oil operator, has a cost-plus deal, it is said. Drilling and Exploration Company, Dallas, has agreed to drill 40 wells.

Lack of funds and equipment has hampered YPF in developing production and imports, which remain at about 50 per cent of consumption and require annual outlay of $50,000,000. There have been discussions with Romania about trading Argentine meat for petroleum. Present domestic oil production is under 50,000 bbl a day.

A new 1100-mile 10-in. gas line from Comodoro Rivadavia field to Buenos Aires, which will be one of the longest in the world, is described in this issue. Plans have been made for two new refineries. The engineering contract for the 28,50-bbl plant at La Planta was awarded Kellogg.

▸ **Aruba, N. W. I.** This island off the North Coast of Venezuela, part of Netherlands West Indies, has one of

[1]Report from S. N. Repal, Alger.

the large refineries of the world with a capacity of 360,000 bbl daily. Charged with Venezuelan crude, the Lago Oil & Transport plant ran a record 434,750 bbl in one day. The Shell refinery here has a 35,000 bbl capacity.

▸ **Australia.** Exploration in this country has been intensified. Australian, British, and American companies evince a determination to explore thoroughly the oil possibilities. (See article on Australia, this issue). Soon to be completed are plants of Standard-Vacuum and Dutch Shell. A plant in which Caltex has a 40 per cent interest has been completed.

▸ **Austria.** All oil activities in Austria are under Russian control and no information is forthcoming even to American and British companies that have large holdings in the country. There is no indication of a development program and output is considered to be down to about 16,000 bbl daily. Only exploration reported was some core drilling in southeastern Austria by Russians.

▸ **Bahamas.** The search for oil in the Bahamas, which started early in 1946, continues. The eight companies that were given exploration rights in the Colony renewed their licenses at the end of 1947 for the further period of 12 months, which is allowed under the Petroleum Act. Geophysical surveys have been carried out over a large part of the concession area. The gravity meter has been used intensively in the marine areas as well as on land: Four companies have used the seismic method, and five companies shared the cost of aerial magnetometer survey over the whole of the Bahamas.

Most of the companies are at present engaged in interpreting their survey data and it remains to be seen if the results justify drilling.

Drilling must be the ultimate test of any new area and it seems unlikely therefore that the Bahamas, which comprise some 50,000 square miles will be abandoned on the evidence of one well. It will be remembered that a dry hole was drilled in North Andros to a depth of 14,585 ft by Superior Oil.[2]

▸ **Bahrein Island.** Caltex operations in the concession on the Bahrein archipelago in the Persian Gulf continue to grow. The huge refinery has a capacity of 162,000 bbl, of which about 30,000 bbl comes from the one Bahrein field and the rest is transtransported mainly by submarine pipe line from Saudi Arabia.

▸ **Barbados, B. W. I.** Recent exploration has improved estimate of island's potential oil resources. Some production reported.

▸ **Belgium.** A new 3000-bbl refinery near Belgrade is in prospect. Belgium has no production.

▸ **Bolivia.** The Bolivian Oil Government Development during July 1947 to July 1948 has engaged in a big expansion program, in both drilling and refinery plant construction plus a pipe line construction as a complementary job to the two oil refineries now building.

Ten new oil wells were drilled, three of which are already in production. Two of these ten wells were drilled in a new oil fields.

The total wells in production are 25, and 20 other favorable structures are in reserve because of the lack of equipment, which is the main handicap to the oil development in Bolivia.

Actually the crude oil yield (about 1350 bbl a day) surpasses the present refining capacity, so the production as a whole is regulated by the refining capacity rather than the well's yield. Because of this fact some of the oil wells had to be shut in.

The crude production was of 12,-277,855 gal U.S., which is divided up in the following percentage of finished products:

0.35% light products
10.64% kerosine
19.24% fuel oil
6.15% diesel oil
1.84% losses

Of the whole crude production about 3,909,834 gal U.S. were exported to Argentina.[3]

Refineries at Suere and at Cochabamba, being constructed by Foster Wheeler for YPFB, will not be completed until 1950.

▸ **Borneo, N. E. I.** In the midst of East Indies conflict Royal Dutch Shell has rebuilt its refineries and stepped up its production in Dutch Borneo. Tarakan and Balikpapan fields have increased production, which is now 13,000 bbl a day, by about 3000 bbl daily over last year.

▸ **Brazil.** Despite Brazil's great oil potentialities the country has virtually no commercial production (about 325 bbl a day) to date. The Brazil National Petroleum Council controls all oil operations and has hired U. S. geologists and contractors to carry on the work.

The Brazilian Congress recently got a bill calling for $2,000,000 to search for oil along the Amazon.

The Rio de Janeiro refinery of 10,000 bbl a day is still in prospect.

Hoover and Curtice have been retained to aid in drafting a new code by which foreign capital may participate in development of Brazilian oil resources. Former drafts for this purpose have left the industry pretty cool.

▸ **British Borneo.** Accelerated production rate has increased postwar production to about 50,000 bbl a day from none at all after fields were destroyed by Japs.

▸ **Brunei.** Production from Seria field, only producing area in this small British protectorate on Borneo, has jumped back after rehabilitation. It is now producing about 55,000 bbl a day.

▸ **Bulgaria.** Another country held silent. Petrol Bulgarian Corporation, of which Socony-Vacuum owned 31 per cent, was expropriated by Communist government. Petroleum operations are a state monopoly.

▸ **Burma.** Civil strife since Burmese independence from Great Britain has not improved conditions for oil production, which was virtually destroyed during the war. About 500 bbl daily appears a safe estimate. Refinery reconstruction is held in abeyance.

▸ **Canada.** N. R. Tanner, Minister of Mines and Minerals, stated this spring that Canadian people believed in wholesome competitive enterprise and that private companies would be required to take all risks and would receive fair treatment. The result of this policy has been large scale leasing, exploration, and a new production record. (See this issue for complete survey of activities.)

Imperial, whose Leduc discovery has developed an estimated 200,000,-000 reservoir, Canadian Gulf, British-American, Atlantic, and Socony-Vacuum, which contracted a 1,800,-000-acre exploratory lease with Canadian Pacific Railway this year, are among the leading searchers. Amerada reentered the field and Stanolind established division offices at Calgary.

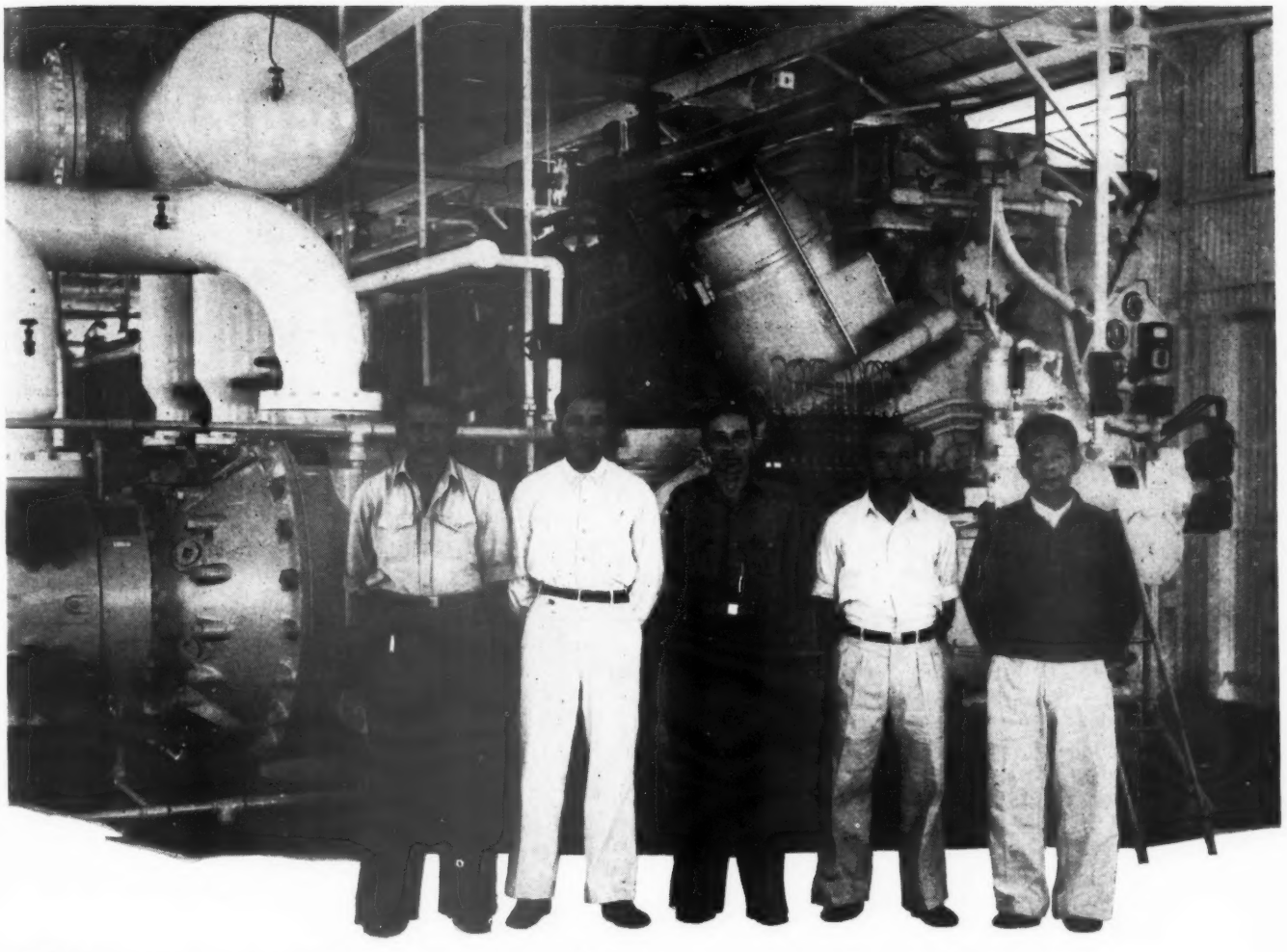
*Imperial Oil.** The west continues to hold the limelight in Canada's oil picture as numerous companies step up exploratory work, including wildcatting, in Alberta, Saskatchewan, and the Northwest Territories.

This intensified activity has been inspired in large part by the fine showing of the Leduc field, which last February 13 celebrated its first birthday. Just 12 months earlier Imperial Oil brought in the discovery well of the field, to date the greatest potential source of crude oil in the Dominion. Leduc's proved reserves are now estimated to be more than 200.000,000 bbl. This means much to Canada as more than 90 per cent of Canada's

[2]Report from Colonial Secretary's Office, Bahamas.

[3]Report of Yacimientos Petroliferos Fiscales Bolivianos.

*Italics give name of company reporting its activities. Imperial is a Standard Jersey affiliate and largest Canadian operator.



These men can give you a tip on engine performance unexcelled!

IF YOU asked these five operators for some good advice on how to get top reliability, efficiency and economy in big engine performance, they would doubtless suggest that you specify Cooper-Bessemers. They have reason to know.

Here, in an important South American plant, power for driving pumps, generators and compressors is furnished by nine 600 hp Cooper-Bessemer GMV gas engines. And here, these men have adopted some mighty high operating standards that have become a slogan: "110% capacity . . . 99% running time . . . 4,000 hp hours per gallon of lube oil." This is just another example of how capable operators and Cooper-Bessemer quality can always get together for truly outstanding performance, month after month and year after year.

Today there are rugged Cooper-Bessemers to meet virtually all heavy duty requirements over 25 horsepower — efficient, long-lived gas engines, engine-driven compressors and Diesels of many types and sizes. You can be sure of engine performance at its finest when you choose Cooper-Bessemers.

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petroleum requirements are imported.

In the 12 months since June 1947 more than 300 wells have been drilled in Canada, chiefly in Alberta and Saskatchewan, with small-scale operations in Ontario. During the 12 months' period Imperial drilled 127 wells of which 40 were dry holes, 14 gas wells, and 68 were oil producers. In June of this year the company had 198 wells throughout Canada on production, yielding an average of 55 bbl a day. The total production for Imperial and subsidiaries during the above period was 3,314,201 bbl.

The search for oil this summer centered in the western provinces and more than 40 geophysical exploration parties were engaged. Imperial had 14 geophysical and six geological parties in the field.

The discovery and development of Leduc field made construction of a local refinery imperative. In 1947 Imperial purchased the Whitehorse, Yukon Territory, refinery (set up during the war to supply the armed forces in the Alaska area) from U. S. war surplus goods for $1,000,000. Plans were made to move it to a 360-acre site just outside the city of Edmonton, about 17 miles north of the Leduc field.

Last winter the Whitehorse plant was dismantled and its sections transported 1000 miles over the Alaska Highway by heavy diesel trucks to Dawson Creek, where it was shipped by rail 350 miles to its site on the banks of the North Saskatchewan River. As a late winter curtailed traffic on the Alaska Highway it was necessary to move some sections by steamer down the west coast to Vancouver and then by flat cars through the Canadian Rockies to Edmonton where it was re-erected. Because of the difficulties of the engineering feat the final cost of the refinery has risen to $8,700,000 but Imperial has been able to save 18 valuable months in getting production under way.

The Edmonton refinery was officially opened in July and is now processing 4000 bbl of Leduc crude daily. It has an operating tankage of 680,000 bbl. By the end of the year it will be in full production and will process 6000 bbl daily, which will help materially in meeting the petroleum needs in Alberta. An increase in capacity to 11,000 bbl a day at a further cost of $2,500,000 is under consideration.

As materials become available oil companies in Canada are tackling long delayed construction and reconstruction programs. After two years of work the modernization and expansion of Imperial's Montreal East refinery was completed this fall at a cost in excess of $22,000,000. This has resulted in increasing the crude running capacity of the refinery by 13,200 bbl to more than 37,000 bbl a day.

The Montreal East refinery now possesses the first fluid catalytic cracking plant in Canada. In addition to the "cat cracker" the new units at the refinery include a light ends recovery plant, a 13,200-bbl per day crude distillation unit and a 4200-bbl per day non-selective catalytic polymerization plant. New storage tanks with a capacity of 2,000,000 bbl have also been erected to bring the refinery's total to more than 200 tanks, with a combined capacity exceeding 5,000,000 bbl.

The company also is considering plans to modernize and expand other refineries in the future when materials are available.

On the pipe line side, during the past 12 months Imperial has constructed a gathering line at Leduc, a loading rack at Nisku (railhead for the Leduc field) and will have completed before the end of the year an 18-mile pipe line from Nisku to the company's refinery at Edmonton. Plans have been made to construct a 450 to 500 mile pipe line from Edmonton to Regina at a cost between $25,000,000 and $30,000,000, if adequate production is obtained.

As a further means of facilitating the transportation of petroleum products Imperial purchased two T-2 type tankers with carrying capacities of 140,000 bbl each. The company also took delivery of three lake tankers, one with a capacity of 55,000 bbl and two with capacities of 24,000 bbl each.

Canadian Gulf. The Canadian Gulf Oil Company presently controls approximately three million acres of land in Alberta, composed of Crown Reservations, Canadian Pacific Railway, Calgary and Edmonton Corporation acreage, and freehold acreage.

Since July of 1947, it has completed five wildcat wells, two in the general area of Edmonton and three approximately 40 miles east of the city of Red Deer in central Alberta. All these have been dry holes. One of the dry holes in the Edmonton area was drilled on the Stony Plain Indian Reserve, approximately 3½ miles north of the Imperial Woodbend producing area. As yet a well has not been drilled on the Michel Indian Reserve, which is also controlled by Canadian Gulf.

In the southwest corner of Alberta, the company drilled a deep Madison limestone test, which appears at the present time to be a gas distillate discovery. Production tests on this well, drilled to 11,790 ft, have not yet been completed. The well set a new record for open hole. Surface string was run to 440 ft and 11,350 ft of open hole was drilled with rotary. A second well in this area is presently drilling below 7000-ft.

Three seismograph crews, one gravity crew and one core hole drill are at work in the company's present exploration program.

British American. The British American Oil Company's production efforts in Alberta consist of geological and seismograph operations carried on by four B-A survey teams. The company also drills wells on its own account there, and in addition shares drilling costs on others with independent operators, in exchange for purchase rights to all crude produced. B-A obtains a substantial proportion of Leduc's total production, for processing at its Calgary refinery.

Extensions to asphalt production facilities at the company's Moose Jaw and Calgary refineries were completed and brought into production last year. When the Montreal extension is finished in 1949, the overall manufacturing capacity at B-A's 5 refineries will have been expanded by 50 per cent.

Largest B-A refinery, at Montreal East, is undergoing extensive alterations, which will double the capacity of existing units to a maximum feed of 32,000 bbl daily. Principal features include fluid catalytic cracking and catalytic polymerization units to manufacture higher octane motor fuels.

▸ **Ceram, N. E. I.** Because of low yields in this small island, the war-damaged fields have not been rehabilitated.

▸ **Chile.** Corporacion de Fomento de la Produccion, government oil monoply for Chile, appears to have opened a new field at San Sebastian, the second discovery in the country. The new production is 55 miles southeast of Spring Hill, where nine tests have been drilled. Provision for refinery or outlets have not been made as yet.

It was announced during 1947 that up to the end of the year the petroleum operations in the Magellanes area of Chile entailed an investment of over $6,000,000. This investment covered the cost of geological and geophysical explorations, salaries, road building, equipment, etc. Under this program 13 wells have been completed; 3 of them on the continent and 10 in the Springhill field, where 2 additional wells were being drilled at the close of the year. Five wells in the Springhill field are producing wells, 3 are gas wells, and 2 were dry holes. Although the wells are capped because of lack of storage and transpor-

tation facilities, 25 to 30 bbl of oil per hour were averaged on production tests. The average depth of the producing sand was 7300 ft. Although oil has been found in commercial quantities, it will be several years before Chile is self-sufficient in petroleum owing to the present scarcity of pipe line and refining equipment. Studies were being made for the construction of a 10,000-bbl petroleum refinery at Valparaiso, and bids were being received on this work by the Fomento Corporation.*

▸ **China.**[4] The civil war in China has been causing great difficulties for all construction work in all industries. The Chinese Petroleum Corporation (CPC), though charged by the Chinese Government with the responsibility of developing petroleum industry in all China, had to limit its principal activities in places of comparative stability.

Kansu. Owing to the declining yield of old wells and shortage of drilling materials to make up for the loss, the production of Laochunmiao oil field in Kansu dropped 510,000 bbl in 1946 to 380,000 bbl in 1947. The situation was especially discouraging during the first half year. Only with the utmost effort the Chinese Petroleum Corporation has somewhat improved the condition. From July 1947 up to the end of June this year seven new wells have been completed and the production has shown an upward trend. On the other hand the refining equipment at Laochunmiao has been modernized and its capacity increased. In 1947 a 2000 bbl per day topping and mild cracking unit was completed and successfully put into operation. Last spring another 1500 bbl per day topping still was also set on stream. Also a vacuum unit and a dewaxing unit are now under construction, aimed at making lubrication oil and asphalt.

Production and refining in Kansu Oil Feld.

	1946	1947		1948
		Jan.-June.	July-Dec.	Jan.-June
Number of wells completed	2	2	4	3
Crude production, bbl	510,000	170,000	210,000	240,000
Gasoline production, bbl	103,000	34,400	60,200	76,000

Taiwan. The natural gas fields in Taiwan (Formosa), having been exploited for some 50 years, are more or less exhausted. Although the CPC has since taken over the fields, repaired quite a few old wells and completed several new ones and thereby somewhat increased the production, the general trend is a rapid decline in production. As the fields have already been extensively drilled, it is improbable that further drilling will increase the production to any substantial extent. The CPC petroleum geologists have found a number of favorable structures on the southwestern plain and exploratory drilling in these areas is under way.

	No. wells reconditioned	No. wells completed	Crude oil production, bbl	Natural gas production, MCF
1945			17,200	1,330,000
1946		1	15,800	1,350,000
1947	11	2	22,400	1,410,000
1948 (Jan.-June)	7		11,734	513,240

The rehabilitation of the refinery at the southwestern port of Kaosiung on this island has made rapid progress since it was incorporated into CPC. In early 1947 revamping of a 7000-bbl topping unit was completed, and the still was put into operation in April of the same year. Last February the refinery completed revamping another 8000-bbl topping still and put it into operation. Owing to insufficiency of crude oil supply (the refinery has been using Middle East crude) the refinery was not operated at its rated capacity. The total crude charge in 1947 was about 450,000 bbl, while during the first half of 1948 it amounted to about 430,000 bbl. At present the refinery engineers are engaged in constructing a 4500-bbl thermal cracking unit, which is scheduled to be completed this fall. A 1500-bbl vacuum unit will also soon be put into operation to make asphalt.

Szechuan. In Szechuan province of western China, a test drilling in Kiangsu did not discover any oil or gas down to 3793 ft. The work has been suspended since Sept. 1947 owing to shortage of material. The natural gas production of the two wells at Shihyukao and Shengteng Shan since last year is as follows:

	1947, MCF	1948 (Jan.-June) MCF
Shihyukao	5,100	2,500
Shengteng Shan	170,000	163,000

▸ **Colombia.** A UP report from Bogota quoted the Minister of Mining and Petroleum as saying that the government would take over Tropical's (Standard Jersey) concession on the expiration date, August 1951, a somewhat discouraging announcement to foreign capital. Tropical is the leading operator in the country and its figures reflect the unrest in the country.

Stanolind is the latest arrival in the South American country. The company went into Bogota at the same time it began activities in Calgary, Canada.

Socony-Vacuum's Cantagallo field, which was discovered in 1943 and now has four wells, was placed on production, and is currently yielding 1300 bbl a day of 20.8 gravity oil. The wells range from 1490 to 6870 ft in depth.

Shell has drilled 5 tests on its San Martin concession.

Tropical. In the period July 1947 to July 1948, ten deep tests were drilled by the Tropical Oil Company of which 6 were completed as dry holes. The remaining 4 wells are still drilling. Seven power rigs and 2 steam rigs were used in the exploratory drilling program. The deep test at Puerto Hamaca, 9211 ft* above sea level, is still drilling.

A serious loss was suffered by Petroleos Ariguani, a joint operation with 50 per cent Colombian and 50 per cent Tropical Oil Company capital, when the wildcat Granada No. 1 blew out on June 4, 1947, and caught fire. All major drilling equipment was lost. On June 11, the fire was extinguished after the hole had caved. Rerigging this exploratory well and subsequent fishing and sidetracking were abandoned when these operations proved to be unsuccessful.

Four rigs and a swing rig were in operation on the De Mares concession, completing 87 wells in 1947 before the drilling program was suspended last November. The swing rig was rigged up by a special crew and the installation synchronized in such a way that the regular drilling crew of a rig, which completed a well, could move immediately on to the swing rig without loss of time. This method proved itself to be very successful since it materially helped to utilize efficiently the available equipment and manpower.

The 4 producing fields of the De Mares concession (La Cira, Infantas, Colorado, Galan) produced 9,692,563 bbl in the period of July 1947 to June 1948. During that period, the Barranca Bermeja refinery had a total crude throughput of 6,433,519 bbl. or a daily average of 17,626 bbl.

The production figures reflect the heavy labor unrest, which prevailed throughout Colombia and which resulted in strikes of varied duration.

The most serious disturbance of Tropical Oil Company's operations was caused by a prolonged strike, originating in the De Mares concession, which spread throughout all divi-

*U. S. Department of Commerce.
[4]Report from Chinese Petroleum Corporation.

*This appears to be a record elevation.

Continued on Page 56

LAUGH WITH BARNEY

"I hear you advertised for a wife. Any replies?"

"Sure. Hundreds."

"Good. What did they say?"

"They all said: You can have mine."

* * *

Kitty: She has been to Reno so many times she has become a little swap worn.

* * *

Weave a wreath for
Trapeze Star Shacht;
His strong-armed wife
Caught him in the act.

* * *

Solution

A student in Penn State's famous fishing class had hooked a very small trout and had wound it in till it was rammed against the end of the rod.

Pupil: What do I do now?

Instructor: Climb up the rod and stab it.

* * *

"Describe a bolt and a nut," a certain high school quiz demanded.

"A bolt is a thing like a stick of hard metal such as iron with a square bunch on one end, and a lot of scratching wound around the other end. A nut is similar to a bolt only just the opposite, being a hole in a little square of iron sawed off short, with wrinkles around the inside of the hole."

He: I wonder what a bride thinks of when she's strolling up the aisle, to the altar, to the wedding hymn?

She: You said it, boy, aisle-altar-hymn.

* * *

He: My treasure!

She: My treasury.

* * *

Mrs. Smith was busily adjusting her new foundation garment when her husband came home for dinner.

"What's mother doing?" he asked his little daughter.

Sue replied: "Dad, she's trying to make a molehill out of a mountain."

* * *

Teacher to History Student: "You want to know why you didn't pass in your history test? Well, your answer to the question 'Why did the pioneers go into the wilderness' was interesting from the standpoint of sanitation, but it was still incorrect."

* * *

Indignant Diner: Hey, this pea soup is full of sugar!

Indignant Waitress: Well, what d'you expect. It's made from sweet peas!

* * *

Every wolf thinks he is entitled to life, liberty and the happiness of pursuit.

"Hello!" called a feminine voice over the telephone. "Is this the Humane Society?"

"That's right."

"Well, there's a book agent sitting in a tree teasing my dog!"

* * *

Felicia: I didn't accept Jim the first time he proposed.

Alicia: No, dear, you weren't there.

* * *

Traffic sign in Pennsylvania village: "Slow, no hospital."

* * *

"Does your new girl know much about automobiles?"

"Heavens, no! She asked me if I cooled the engine by stripping the gears."

* * *

A man inspected his wife's new bathing suit, and remarked caustically, 'Shirley, it is just big enough to prevent your being tanned where you ought to be."

* * *

In New Orleans they tell of a northerner who walked into a bar, declaimed loudly that the French Quarter was smelly, the women ugly and the streets shabby.

But after one long pull on a Sazerac, a local drink, he thawed a bit. "I guess maybe a few of the girls here are pretty."

He ordered a second Sazerac and a few minutes later observed: "The French Quarter does have a sort of charm to it, I suppose."

He ordered a third Sazerac, tossed it down, and pulled out a $100 bill. "Gimme my change in Confederate money."

* * *

One of Henry Ward Beecher's favorite stories was about a young man who was applying for a job in a New England factory. Asking for the owner, he found himself in the presence of a nervous, fidgety man who looked hopelessly dyspeptic. "The only vacancy here," he told the applicant, "is a vice-presidency. The man that takes the job must shoulder all my cares."

"That's a tough job," said the applicant. "What's the salary?"

"I'll pay you ten thousand a year if you will really take over all my worries."

"Where is the ten thousand coming from?" asked the applicant, suspiciously.

"That, my friend," replied the owner, "is your first worry."

* * *

Man (dining in a small town hotel): Why does that dog sit and watch me all the time?

Waitress: You've got his plate.

CLEAN UP THE "WORKING SURFACE" OF YOUR CASING

Read these facts about the Baker Rotary Casing Scraper

Have you ever tried to run testing tools or a swab, and had the rubber packing unit or the rubber cups so badly cut, torn and mutilated that the run was a failure? The chances are that trouble was caused by burrs from gunshot holes or by the sheath of hardened cement or mud which remains on the inside walls of casing, even after a bit of maximum possible gauge has been used to drill out after a cement job.

Until quite recently there was no fast, simple method of overcoming these difficulties. Now, however, it is truly a waste of time, temper and money to leave any obstructions adhering to or protruding from the "working surface" of your casing. The Baker Rotary Casing Scraper quickly, positively and economically removes *all* obstructions from the inside walls of casing, leaving the surface clean and smooth—ready for *immediate* testing and completion—and in good condition for any remedial or work-over operations *one year or ten years in the future.*

STRONG, SIMPLE CONSTRUCTION

The Baker Rotary Casing Scraper consists of a strong body in which three long, reamer-type, hard-faced blades are vertically mounted. These three blades form an expansible reamer due to the fact that they are pressed outward against the inside walls of the casing by a number of coil springs. This self-equalizing feature insures constant, uniform contact with the walls of the casing, and is one of the secrets of the clean, smooth scraping action. Hard facing is applied in a flat, rectangular recess to form the long cutting edge of each blade, and a worthwhile amount of scraping can be done before the blades are dulled.

Ample circulating areas permit free disposal of cuttings; the streamlined exterior of the body insures ease in running-in; and if by accident the Casing Scraper is run out of the lower end of the casing, there is no difficulty in bringing it back inside for removal from the well.

FACTS ABOUT ITS USE

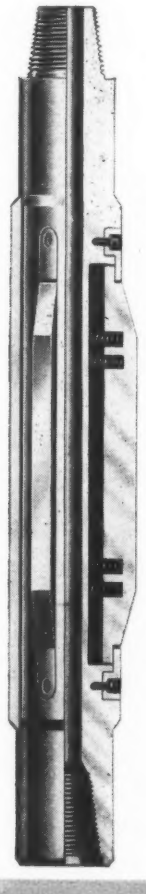
The ideal time to use a Baker Rotary Casing Scraper is while the rotary rig is still up and the crew is on hand. Install the Casing Scraper just above the bit when going in to drill out the cement shoe. Even when a bit of the maximum possible gauge is used for drilling-out, a thin, hard sheath (or skin) of cement will still remain adhering to the inside walls of the casing. The Baker Rotary Casing Scraper removes not only this hardened sheath of cement, but also scrapes away all mill scale, and smooths out rough areas. The inside of the casing is left clean and smooth, ready for trouble-free, down-hole work immediately thereafter, or at any future time.

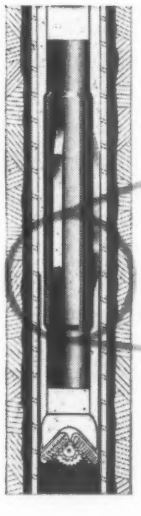
If the well is gun perforated, then a second run of the Baker Rotary Casing Scraper will remove any burrs left around the gun-shot holes. The slight additional cost of this second run is negligible when you consider what the clean, smooth casing will mean when any future down-hole work is done.

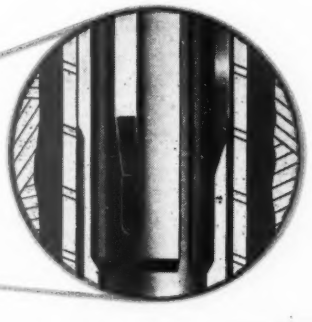
If at a later time, after the rotary has been removed, obstructions on the inside walls of the casing interfere with operations, the Baker Rotary Casing Scraper still can be employed successfully. By running the Casing Scraper on tubing, and rotating manually with tongs, limited areas may be scraped; while several hundred feet of casing have been scraped by rotation of the tubing with an endless spinning rope, or by means of air tongs.

IT'S EASY TO HAVE THE "WORKING SURFACE" OF YOUR CASING IN PERFECT CONDITION

Baker Rotary Casing Scrapers are furnished on a low-cost rental basis in domestic fields, and *your* crews can run them easily and successfully to scrape the "working surface" of the casing before running casing, tubing, liners, swabs, testing tools, cement retainers, packers or other similar tools. It pays off in savings of time, temper and money.—Why not call the nearest Baker service engineer and start enjoying these benefits in *your* wells?







BAKER MODEL "B" ROTARY CASING SCRAPER
Product No. 620-B

BAKER OIL TOOLS, INC. LOS ANGELES • HOUSTON • NEW YORK

Continued from Page 53

sions including the wildcat drilling rigs. The dispute arose over dismissals of workers no longer required because of a reduced drilling program. The strike lasted from January 7, 1948 till February 25 and only 2 wildcat rigs, out of 6 drilling during that period, remained in operation.

The Colombian Army took over the distribution of petroleum products, which had to be imported from Peru and Aruba.

During the Revolution of April 9, operations in the De Mares concession and in the Baranca Bermeja refinery were shut down but no major damage was caused to company property. One wildcat rig, out of 5 drilling at that time, was shut down by the Union from April 9 to April 16, 1948.

Phillips. A number of applications by Phillips Petroleum Company for concessions are now on file with the Colombian government. At the present time the company has two surface geological parties working in Colombia.

Sinclair. Sinclair-TriPet Corporation (Sinclair, Cities Service, Richfield)—*Companias Unidas de Petroleo* has completed one well at a total depth of 7365 ft on the San Andreas concession in the Caribbean coastal area. The company is now drilling a second well approximately one mile east of the first and has now attained a depth of 2400 ft. Extensive geological and geophysical work is now being carried on in other parts of the coast and lower Magdalena Valley.

Texas Petroleum Company. Velasquez No. 3 was completed in December as the second producer in the area for 510 bbl per day. Wells No. 4 and 5 were carried into basement below 8000 ft and, failing to find oil, severely limited the extent of the productive area. The two producers will be placed on commercial production shortly.

In the coastal area, Buenavista No. 1 was abandoned at 11,590 ft after finding minor shows of gas, while Pinto No. 1, drilled jointly with Socony, was abandoned at 11,206 ft without significant shows of hydrocarbons. El Jobo No. 1, also a joint venture with Socony and the second test of the Tablon concession, was completed for 15,400,000 cu ft of gas after reaching 6944 ft. El Jobo No. 2 is currently drilling down dip from No. 1.

In the Caqueta area of southeast Colombia, two stratigraphic tests were drilled—Solita No. 1 to 3724 ft on the Mununguete concession and La Rastra No. 1 to 3094 ft; the third, Jose Maria No. 1 was rigging up on the Cananguchal concession.

▸ **Congo.** Belgian and South African mining technicians, working for Congo and Uganda governments, report satisfactory results of exploration drilling. Prospecting is along British and Belgian shores of Lake Albert, where oil seepages have long been known. Belgian Congo is already the world's chief producer of uranium and radium ore.

▸ **Cuba.** A subsidiary of Shell drilled a well to approximately 10,500 ft on Cayo Coco, on the north coast of the island. After being tested, this well was abandoned in September 1947. Seismograph work by Shell on the north coast was terminated around March 1948. Subsidiaries of Standard and The Atlantic Refining Company have suspended operations in Cuba for the present.

Gulf Oil Corporation is presently conducting seismograph work on the north coast of Cuba and recently brought a drilling rig into Cuba.

A 1000-bbl capacity plant is planned for Jarahueca.

▸ **Curacao, N. W. I.** Shell's refinery has a throughput higher than its capacity of 275,000 bbl, because of greatly increased crude production from Venezuela to the South.

▸ **Cyprus.** A subsidiary of the Iraq Petroleum (British, American, Dutch, French) has made a seismic survey of the island. Work was done by The Seismograph Service Corporation of Tulsa.

▸ **Czechoslovakia.** The huge Joseph Stalin Works, once the Adolf Hitler Works, produces gasoline from brown coal. The country also processes Hungarian crude oil and total production last year was believed to be some 6,000,000 bbl. The bulk of this probably goes to Russia. The Czech two-year plan called for 1,350,000 bbl of crude per year but no official figures are available from this Red-controlled country.

▸ **Denmark.** Danish American Prospecting Company has during the past year carried on exploratory activity in Denmark with the following operations: One large Emsco rig, with which one hole, Vinding No. 1, has been completed at a depth of 7985 ft as a dry hole. Another test, Gassum No. 1, is now drilling north of the town of Randers at a depth of 5000 ft. A semi-portable Cardwell rig has drilled two tests on a salt dome, one of these to depth of 4986 ft, and another to a total depth of 5061 ft. A Sullivan truck-mounted rig has drilled 21 shallower tests, principally for salt.

One seismograph party has been in continuous operation throughout the year. A gravity survey of all of Denmark has now been completed with a total of 19,000 stations. Numerous salt domes have been discovered by geophysical methods, and in four of these the salt has been drilled.

The operations employ 16 American technicians and about 160 Danes. The work is being carried out by the Danish American Prospecting Company, a subsidiary of the Gulf Oil Corporation of Pittsburgh. The work is under the management of Albert Gregersern.[5]

▸ **Dominican Republic.** Concessions were surrendered to the government by Dominican Seaboard Company after 8 years exploration. Fifteen tests revealed some oil but none brought in commercial production.

▸ **Ecuador.** Shell continues exploration in the El Oriente area. Anglo-Ecuadorian Oilfields, Ltd., is developing its new field in Ancon area. The accompanying table shows recent crude production and refining output.

▸ **Egypt.** A Shell-Socony-Vacuum combination, Shell-operated, has found a new field on the Sinai peninsula at El Asl, about 10 miles south of the Sudr field, discovered in 1946. Three productive wells and several other tests have been drilled. The field is scheduled to go into production late this year.

The two Suez refineries are running

[5]Report supplied by Danish American Prospecting Company.

Ecuador—Production of crude petroleum[6]

1947	101,910,934 gal.
1948 (first half)	54,330,754 gal.

Petroleum products—U. S. gallons.

Year	Gasoline	Benzine	Slops	Kerosine	Diesel oil	Lubricants	Gas oil	Residuum	Distillate	Asphalt	Tar
1947 (1st half)	15,767,368	821,785	.....	3,925,909	8,112,608	149,143	101,498	24,501,681	...	3147	217
1948	8,583,551	276,778	301,955	1,621,779	5,381,089	93,234	92,857	11,030,805	264,961	593	793

Refined oils and lubricants.

	Oils, lb	Greases, lb
1947	164,870	18,135
1948 (first half)	93,107	13,185

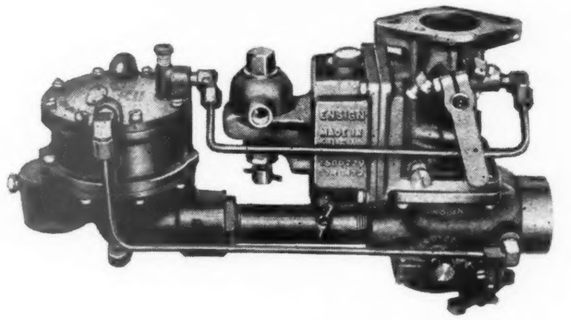
Natural gasoline.

1947	2,236,889 gal.
1948 (first half)	1,493,874 gal.

[6]*Table supplied by Director General of Mining and Petroleum, Ecuador.*

ENSIGN

CARBURETION



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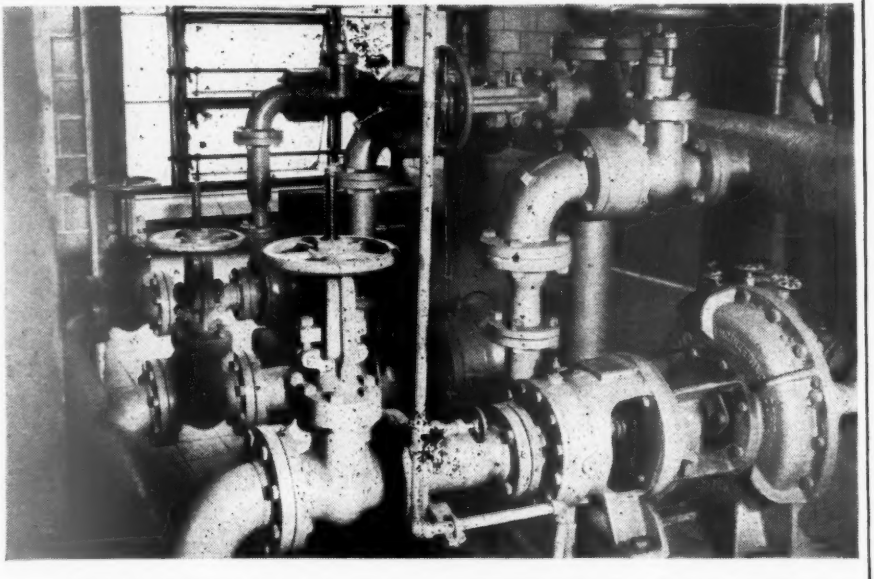
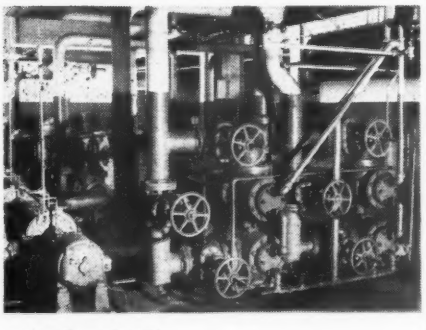
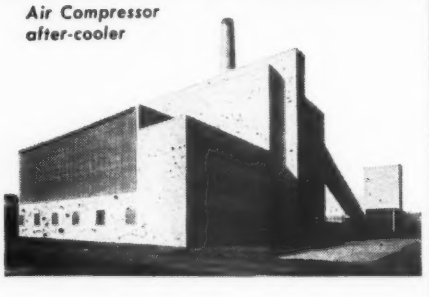


Feedwater treatment transfer pumps

The new power house at Sherwin-Williams' Chicago plant is the last word in efficiency. From the three, 3-drum, bent-tube boilers to the make-up water treatment system, every item of the installation was selected for trouble-free, economical operation. It's only natural therefore, that the list of principal equipment specifies Lunkenheimer Valves.



Air Compressor after-cooler



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at capacity of about 37,000 bbl daily. Total Egyptian production runs about 30,000 bbl daily.

▸ **England.** Six small oil fields are producing in England and Scotland for a total of about 900 bbl daily and most of the crude needed for the country's 113,073-bbl refining capacity is shipped from the Middle East. Exploration is carried on by Anglo-Iranian and Standard Jersey, which hold government concessions.

▸ **Ethiopia.** Sinclair, which holds sole concession from government, reports it has suspended operations temporarily. The first of the year some native clashes interfered with exploration activities.

▸ **France.** Three companies, owned wholly or in part by the government, are operating in southwestern France, with 20 powerful rigs, drilling, for an average, to a depth of 8000—10,000 ft. Two wells reached a depth more than 13,000 ft and are believed to be the deepest ones ever drilled in Europe. The total footage drilled in 1947 amounted to 120,000 ft of which 90,000 ft were drilled to a depth of 8000 or more.

Thirteen wells were completed by the rigs, 9 of them wildcats. The 4 development wells showed good producers of gas in Saint Marcet area. The largest oil producing area, Pechelbronn, in northeastern France, is nearly completely rehabilitated and is operated by a private company. The production here obtained is now holding the 1000 bbl a day figure and is gradually climbing back to the prewar figure (1400 bbl a day.)[7]

Refineries.[8] Continuing its efforts for a complete reconditioning of its refinery plants, France in 1947 imported 37,370,000 bbl of crude oil out of which 37,222,000 bbl were processed or run in stills.

On January 1, 1947, the running capacity of its refineries represented 24 per cent of their pre-war total capacity, while on the 1st of January 1948, their processing capacity had increased up to 86 per cent and it is expected that 80 million bbl may be processed in the course of this year (11 million TM), when their prewar total capacity will then be about 12 per cent in excess.

The fact that the processing capacity, within the year 1947, could largely exceed and that the production could come up to French expectations was mostly due to the circumstance that, in order to produce as much gas-oil and fuel-oil as possible, some of the cracking-plants were operated as topping plants.

[7] Ministere de la Production Industrielle report.

The want of steel and currency did not permit the fitting up of new or modernizing of already existing equipment required for an up-to-date technical production and plants are therefore unable to produce lubricants having a high viscosity-index nor high octane number motor-fuels.

Besides, the year's production of French national fuel-oils has been the following:

Natural gasoline (natural gas)	7,300 t = 62,000 bb
Crude oil	50,000 t = 350,000 bb
Schistous products	16,300 t = 117,000 bb
Synthetic products	3,000 t = 22,000 bb

▸ **Gabon.** In the Gabon Basin of French Equatorial Africa, the company in charge of exploration is now operating with two new rigs, purchased in the United States. Topographical, geological, and geophysical surveys are in progress.[7]

▸ **Germany.**[9] *Crude Oil Production.* Nothing of outstanding importance to report for the year ending 30th June 1948. Drilling and production continue at approximately the same level. Whereas production in the Emsland area fields continues to increase many of the older German fields are declining fairly rapidly.

The following figures will be of interest:

Drilling footage and completions.

	Feet	Completions—Wells	Completions—Productive
Exploitations	182,408	73	63
Extension	42,926	14	4
Exploration	163,825	35	1
Total	389,159		

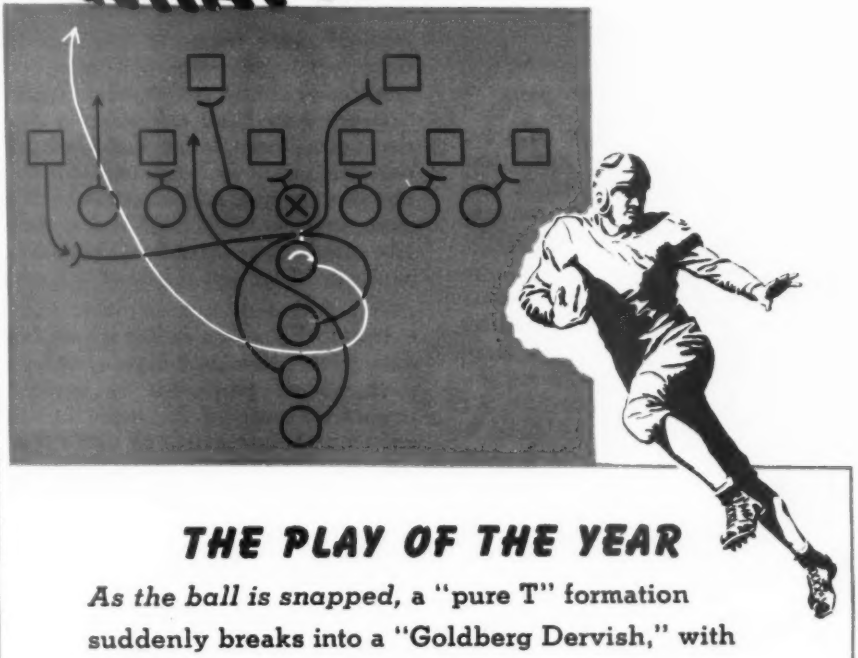
Crude oil production for the year ending 30th June 1948 was 4,135,730 bbl.

Refining operations. The refineries in the combined British American zone, all of which are actually in the British zone, processed all the indigenous produced oil delivered during the year ending June 1948. In addition imported crude to the amount of 559,440 bbl was refined. The first tanker of imported crude to be delivered to Germany since the occupation arrived in August 1947. It was necessary to use asphaltic crude because of the limited dewaxing capacity; therefore until June 1948 only Venezuelan crude was imported. One cargo of Middle East crude, a forerunner of future supplies arrived in June this year and processing commenced in July.

Rehabilitation of damaged refineries, particularly dewaxing plants, has proceeded slowly but it is expected by July 1949 that the refineries will be

[7] Ministré de L'Industrie el du Commerce.
[9] L. R. Hulls, Chief, Oil Section, Bipartite Control Office, Frankfurt, Germany provided this report.

WHAT A PLAY!
WHAT A MOVEMENT!



THE PLAY OF THE YEAR

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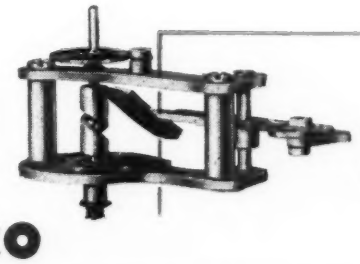

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able to increase considerably their intake of Middle East crude.

Details of refinery operations in the combined British American zone are as follows for the year ending June 30th 1948:

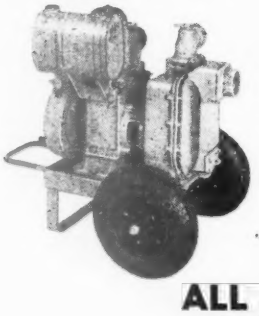
		Bbl.
Crude processed	Indigenous	4,103,688
	Imported	559,482
Output of main refined products	Gasoline	640,263
	Kerosine	413,935
	Gas oil	508,203
	Lubricants	1,272,782
	Bitumen	414,946

▸ **Guatemala.** The new law covering oil concessions presents some bad features. Three firms, two U. S. and one Guatemalan-U. S., hold concessions.

▸ **Haiti.** Exploration work was continued by The Atlantic Refining Company upon concessions aggregating some 200,000 hectares, in which Haitian Petroleum Company had an undivided interest. Well Cul-de-Sac No. 1 was drilled to a final depth of 8064 ft in April 1947. Results of testing were negative and the well was abandoned as a dry hole. Another well, St. Marc No. 1, was drilled to about 4100 ft in September 1947, when it was abandoned, dry. Field operations were concluded near the end of 1947 and all petroleum concessions were renounced.

The only concession now held is in the name of William Less.

MP PUMPS



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▸ **Hungary.** What can be learned of Hungarian oil operations since the country has been taken over by the Communist regime concerns inefficiency in management and decreases in production. Two Standard Jersey executives were recently seized and charged with sabotage before being released. This company was among those whose oil properties were expropriated by the government.

Reports by Standard officials that the fields were being damaged by overproduction is borne out by the fact that the goal sent for 1949 by the government is 4,950,000 bbl, less than 1946 production. Actual production is probably about two-thirds of this objective.

▸ **India.** The new independent Indian government will leave development of oil properties to foreign private interests for 10 years. At the end of that time it will be decided if government will take over operation.

Only one field remains since the partition of India and Pakistan. This is the Digboi area, extreme northeast part, which produces about 5300 bbl a day. Assam Oil Company's refinery at Digboi is processing some 7000 bbl a day crude oil, which is more than its 6286-bbl rated capacity.

▸ **Iran.** Production from Anglo-Iranian's 100,000-sq-mile concession in southwest Iran continues to make a substantial rise running some 550,000 bbl a day at present. Some of the increase is contributed by the new Lali field, to the north of the 7 other producing areas.

Most of this crude is fed into the largest refinery in the world at Abadan, with a capacity of 500,000 bbl a day. Additions to the refinery are being made presently.

▸ **Iraq.** Palestine's strife has cut down production from Iraq's prolific field, Kirkuk, from which output is piped outside of the country. In 1947 about 92,000 bbl daily was carried by two pipe lines to the Mediterranean but present pipe line runs are less than 80,000 bbl and production must be held to this figure.

The new Kirkuk-Haifa line has been laid and can go into operation this winter unless held back by more political unrest. The new Kirkuk-Tripoli line is under construction. A refinery, to be bought in the U. S., is planned by the Iraq government to process more oil for domestic use. The plant would cost about $12,000,000.

▸ **Ireland.** The North Ireland government has begun exploration for bituminous products. Two deep wells are to be drilled east of Coalisland.

When completed the new oil terminal at Cork, Eire, will have a capacity of 80,000 bbl.

▸ **Italy.** Government offices are having difficulty coping with large demand for drilling concessions. One test is scheduled for 9000 ft by Italian, British, and American (Standard Jersey) interests and a dozen or more tests have already been drilled this year.

A large refinery for imported crude is in prospect for Apuania. Swiss-English interests plan a 30,000 bbl processing unit. Part of the Marshall plan is a sharp increase in refining capacity in Europe. As Italy is easily accessible to Middle East crude it is probable expansion in refining will soon double the present figure of about 33,000 crude daily.

▸ **Japan.** In recent months Japan has raised its production by an addition of some 700 bbl of oil daily from a new discovery and some development wells. This brings the figure to only about 4000 bbl, amounting to 15 per cent of the consumption. Most refineries in the country damaged by war were shut down and only a few have been or will be repaired and put into operation. None are modern.

▸ **Java, N. E. I.** Increased political unrest in Indonesian Republic recently has discouraged move toward rehabilitation of fields and refineries. Java probably contributes not more than 1000 bbl a day production from the Kroeka field.

▸ **Kuwait.** The bonanza field, Burghan, is producing about 120,000 bbl daily and is still limited by transportation. This is the field, owned by British-American interests, said to have a reserve of 9 billion bbl. Oil is piped to terminal on the Persian Gulf and shipped by tanker. Pipe line facilities may later link this field to American-Arabian pipe line.

American Independent Oil Company (owned by a number of smaller U. S. companies) has been granted a concession over the neutral zone between Kuwait and Saudi Arabia. By the contract Sheik Ahmad al Jabir al Subah, ruler of Kuwait, will become a minor partner in the deal.

▸ **Lebanon.** Concession is held by Lebanon Petroleum, which is drilling a test close to Tripoli.

▸ **Liberia.** Cities Service has signed new contract for exploratory rights covering whole area of this Negro republic on African West Coast.

▸ **Libya.** Reports of an oil discovery in the area next to Algeria come from this Northwest African country.

▸ **Madagascar.** Geological and geophysical surveys are pursued in order to appraise the basin structure and to

prepare drilling locations near the Mozambic channel.[7]

Manchuria. Now under Russian control there is no news of oil activities. American observers last year visited oil shale operations, largest in the world.

Mexico. The last 12 months have been marked by greater exploratory drilling and the first important strike since Petroleos Mexicanos, government monopoly, took control of expropriated oil properties, by constant flirting with American capital, and by the signing of the first contract with a large oil company.

Cities Service affiliates are to receive $1,000,000 indemnity for properties expropriated in 1938, it was announced soon after the company signed a contract to finance development of former Cities Service properties by Pemex. The Texas Company followed with an agreement to lend capital for crude. Other companies are listening to similar proposals but not, apparently, very hard.

Although exploration has increased it is far below plans set by Pemex, for which the company blames difficult technical problems. Production coasted along at 150,000 bbl a day.

Representative Charles A. Wolverton (Rep. N. J.) lead a Congressional committee to Mexico to study Mexico's petroleum industry. Wolverton appeared sympathetic toward Pemex's plea for machinery and equipment and also for the money to buy them—$45,000,000 was suggested according to reports.

Morocco. A company, chiefly owned by the French and Morocco states, is now operating with 7 rigs and drilling is very extensive (80,000 ft drilled in 1947). A new field was just discovered in the Plaine du Rharb area and is now in development with a production of 200 bbl a day.[7]

Netherlands. At the end of 1947 the first Dutch oil field, Schoonebeek, had 38 wells in production. Average production for year was 4000 bbl, but present output is double that. The oil sand is 100-ft thick at a depth of about 2500 ft and the field is estimated to cover 2500 acres.

Royal Dutch Shell and Standard Jersey, which own the company operating in Holland, are doing considerable exploration.

New Guinea. (See Papua.)

Nicaragua. *Atlantic.* Gulf Oil and The Atlantic Refining Company continued exploratory work along the east coast of Nicaragua in 1947 but temporarily suspended operations around the middle of 1948. The second test well, Twara No. 1, was drilled to about 6300 ft, where it was plugged and abandoned in March 1948. Seismograph operations were also concluded around the same time. A limited amount of field geological work was continued.

Nigeria. Anglo-Iranian and Shell are doing some exploration work in this British West African colony.

Pakistan. New oil production at Balkassar and Joya Mair has almost kept up the volume of around 1000 bbl a day in this dominion of partitioned India. The new fields are close to old production areas in a northwest direction toward Afghanistan. Attock Oil has two small refineries with total capacities greater than production.

Palestine. The constantly shifting political situation has put a lid on any progress in oil operations. After being shut down three months the Haifa refinery (British-Dutch) was put in production again by the Isreali government in July. The conflict between Jews and Arabs has held up new pipe line installations.

Petroleum Development Company is still drilling test near Gaza. A new location is planned on Kurnub structure.

Panama. *Sinclair.* Sinclair Panama Oil Corporation is drilling a deep test on Colon Island about six miles from the town of Bocas del Toro. The well is now below 8000 ft. The company is carrying on extensive geological surveys in other parts of Panama at the present time.

Papua. Exploration proceeds in this southeast part of New Guinea. The Kariava test, begun in 1939, went a TD of 12,621 ft this spring and was abandoned. (See Australiasa in this issue.) Two other locations have been made near Gulf of Papua.

Paraguay. Union Oil Company of California has had no success with two wildcats in Santa Rosa area. A third one is now drilling. There are about 55,000,000 acres in Gran Chaco contract.

Philippines. The Far East Oil Development Company, Inc., now known as the Philippine Oil Development Company, Inc., completed drilling its well on the north end of Cebu Island in December, 1947. The well reached a total depth of 9950 ft having penetrated all of the sedimentary formations. The basement was reached at 9945 ft. First oil indications were encountered at 1640, but the best showings of oil were found below 7650 ft to bottom of the hole. The well is now standing suspended and further remedial work will be carried on later. In the meantime, the Philippine Oil Development Company, is carrying on its drilling operations on the Bondoc Peninsula on southwestern Luzon. Drilling is going on at about 1300 ft.[10]

Recent government policy tends toward restriction of foreign interests in oil exploration and interest of American companies is waning.

Peru.† Oil production in 1947 increased to 12,763,807 bbl or 2.5 per cent over 1946 oil production of 12,455,991 bbl. Natural gasoline production in 1947 was 1,007,438 bbl in comparision with 1,041,536 bbl for 1946, a decline of 34,098 bbl.

Early 1948 Peruvian crude oil production is showing a slight increase over late 1947 months. There is no change in position of producing companies nor 1948 outstanding developments in comparision with 1947.

Decree No. 11 of April 2, 1948, reformed the Establecimientos Petroliferos Fiscales (the state-owned company) as the Empresa Petrolera Fiscal, giving the new EPF much more autonomy. An important feature of Decree No. 11 was Article No. 10, permitting EPF to contract with private operators the exploration and exploitation of areas of state reserve lands, such contracts requiring only approval by the Executive Power and not that of the Peruvian Congress. No foreign oil company appears, as yet, to have taken advantage of Article No. 10 to open negotiations with EPF, due to the possibility that some future Congress might question the legality of the new Decree.

The recent oil-wheat exchange agreement between Argentina and Peru, providing for transfer to Argentina 6,000,000 bbl of oil over a 4-year period, if ratified, may give outlet to additional Ganzo Azul (Peruvian Montaña area) crude, according to newspaper advices.

Peru 1948 production:

	Natural Gasoline	Crude Petroleum
July	1,088,164	82,836
August	1,088,628	82,723
September	1,012,701	64,978
October	1,097,634	85,884
November	1,075,693	85,010
December	1,112,466	92,620
Total	6,475,286 bbl	494,051 bbl

Poland. Four-fifths of prewar Poland's oil operations are in the part annexed by Russia so only the small fraction left is considered under present day Poland. Production fairly steady at between 2500 and 3000 bbl daily. Communist reports say that Poland gets heavy imports from Russia.

Portugal. A wildcat operation was begun northwest of Lisbon by Anglo-Portuguese Oil Company.

Portuguese East Africa. (Mozambique) Gulf Oil was granted a 45,000-sq-mile concession. Manica Trust (British-Portuguese) is exploring its concession.

[10]Report from Philippine Oil Development Company.

†Instituto Geologico del Peru supplied report.

▸ **Puerto Rico.** The government Industrial Development Company has appropriated some $300,000 for geological and geophysical studies of oil possibilities. United Geophysical Company, California, is doing the work and reports good prospects already have been found.

▸ **Qatar.** Operations at Dukhan field were resumed in 1947 for first time since discovery in 1939 and Well No. 6 is now drilling. This British holding has a vast potential. Shell and Gulf plan a new pipe line from here to Kuwait. Geophysical work covers most of peninsula.

▸ **Romania.** Within last 12 months the government has taken over entirely the oil properties of British, Dutch, American, and domestic interests. Reports of slight increase in production to 80,000 bbl a day come from government agency in charge. Of this between 40 and 50 per cent goes to Russia.

▸ **Russia.** In this perennial guessing game about Russia's oil resources almost any answer is available if you read enough. Last year we estimated that Russia's oil supply was adequate for its needs.* The Soviet press and Associated Press reports from Moscow during the past year bolstered this theory although for a different reason. Our contention was that the industrial movement hadn't got ahead of oil production because it was slow. The Soviet press, on the other hand, indicates supply is ample because of increased production in eastern fields, which was said to be 40 per cent over 1947. Total Russian production, figured from Soviet releases, is about 570,000 bbl a day, compared to 400,000 bbl in 1945; 455,000 bbl in 1946, and 520,000 bbl a day average in 1947. There are still 12 years to achieve the Soviet goal of 1,200,000 bbl a day by 1960.

▸ **Sarawak.** (Borneo Is.) British company, Sarawak Oilfields, reports steady increase in production at Miri. Output is around 1000 bbl a day now. A new refinery is planned on Maura Island.

▸ **Saudi Arabia.** Production increased sharply in the last year to some 400,000 bbl a day at present. The Buqqa discovery is now believed to be an extension of Abqaiq. The Ras Tanura refinery, with a 50,000-bbl capacity, is refining some 115,000 bbl a day. Output here has been vital in filling needs of U. S. Navy. The Saudi Arabian concession is held by Arabian-American Oil Company.

Work on 1100-mile big crude oil pipe line from producing fields to Mediterranean has been held up from time to time by shipment of materials and by political conflict but construction is under way and progressing.

▸ **South Africa.** Plans are completed for a $50,000,000 Hydrocol plant in the vicinity of Cape Town. Liquid fuel is produced from oil shale and coal. No petroleum has been found in this country and no exploration is in prospect, reports the Government Geological Survey.

▸ **Spain.** No change has been caused in the drilling undertaken by the government monopoly in the Burgos neighborhood. Drilling is going on now.

The Compania de Investigacion y Exploraciones Petroliferas, known as C.I.E.P.S.A., has completed a well in the province of Lerida, and is now drilling a second hole in the province of Soria.

The Cartagena refinery is still under construction.

The Tenerife refinery, in Canary Islands, owned by Compania Espanola de Petroleos S.A. (C.E.P.S.A.), is now working at its maximum capacity. Expansion is now in progress, and the total output will be increased 50 per cent. The enlarged nominal capacity

*"The Soviet Oil Supply Adequate," by Ernestine Adams, The Petroleum Engineer, October, 1947, P. 162-164.

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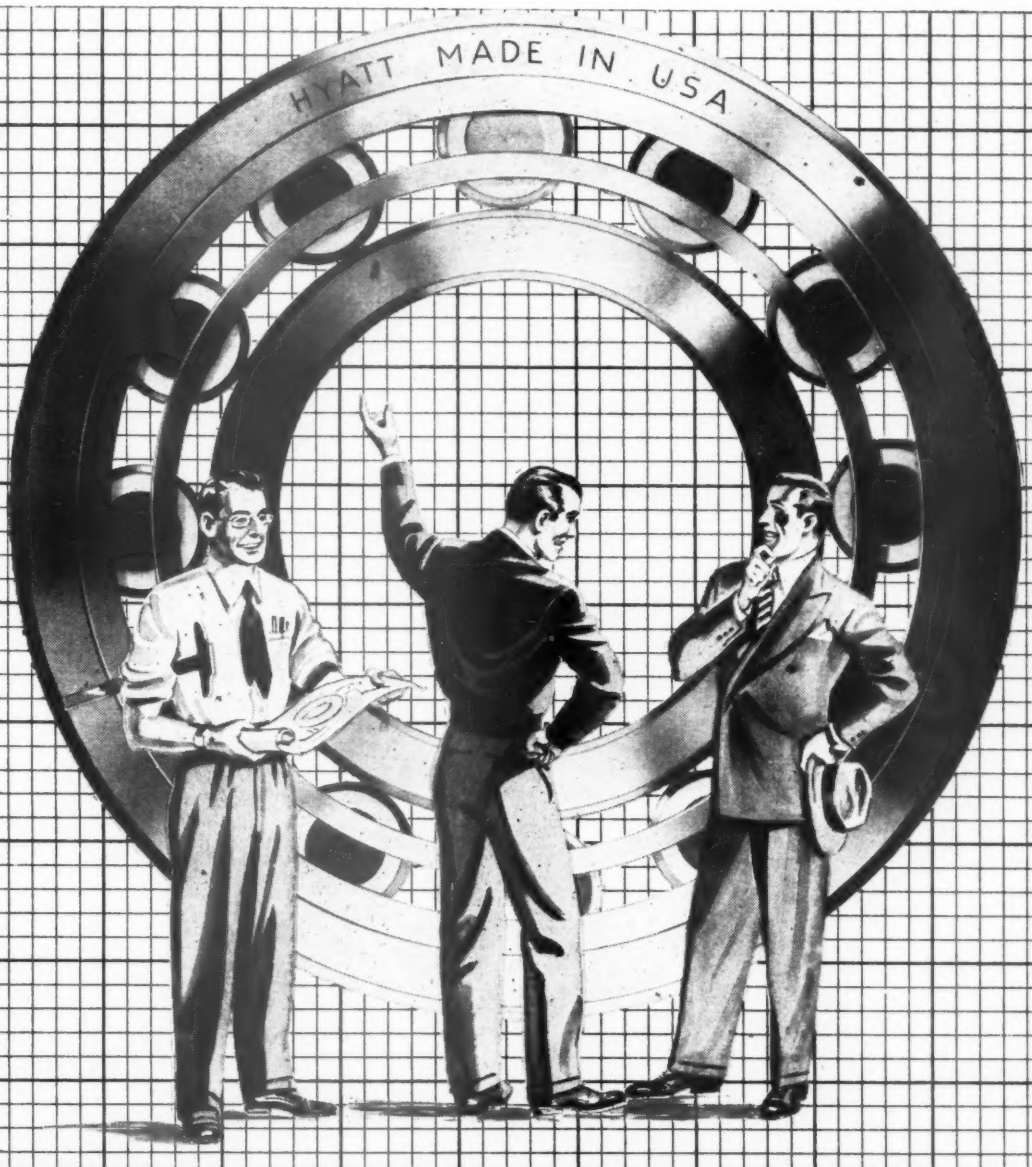

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will be 15,000 bbl a day. The new facilities are expected to be running in late 1949.[11]

Late reports stated that Caltex was considering combining with C.E.P. S.A. and Instituto Nacional de Industria to build a 20,000-bbl refinery.

▸ **Sumatra.** Unstabilized political conditions may put a damper on steady increase in production from rehabilitated fields and rebuilt refineries. In July Standard Vacuum's Soengei Gerong refinery had daily runs of 46,000 bbl, surpassing prewar output. The Palembang and Pladjoe plants are being modernized.

▸ **Sweden.**† There was no success with the two wells drilled at Hoellviken and the work there is finished. The State Fuel Commission will, however, soon start again with new drilling at another place in the neighborhood of Hoellviken. At this place it will go deeper than at Hoellviken, where they reached a depth of about 6562 ft.

The plans for a pipe line between Gothenburg and Stockholm are not actual at present.

The refinery under construction at Gothenburg will start in the beginning of 1949 with an annual production of about 3,000,000 bbl in full operation. With the refineries at Nynäshamn and Malmoe the total Swedish capacity will amount to about 2,750,000 bbl yearly exclusively of lubricating oils and asphalt with an unchanged import of crude oil.

The domestic production of oil, which comes solely from shales, will run to about 300,000 bbl during the present year. For 1949 the same quantity will be produced.

▸ **Syria.** Exploratory drilling is being carried on by concession holder, affiliates of Iraq Petroleum. A test at Baffioun and another at Dolaa are being drilled.

▸ **Transjordan.** Geological and geophysical work is in progress by Transjordan Petroleum Company, which owns concession covering country.

▸ **Trinidad.** Increased activity was a noticeable feature of 1947 when, in addition to a considerable amount of exploratory drilling being carried out by various companies, several parties were engaged during the year in carrying out geophysical surveys both in the marine areas that lie between the Island and Venezuela as well as on land. Footage drilled increased in 1947 to 645,900 ft from the 1946 figure of 524,066 ft.

Production showed a slight increase from 20,173,027 bbl in 1946 to 20,472,313 bbl in 1947.

On the refining side, the Colony, with a capacity at the present of 34,000,000 bbl per annum, is now importing crude oil, in larger quantities. Throughput for 1947 was 26,504,960 against 21,080,479 bbl for 1946.

Negotiations have recently been concluded resulting in the payment of increased crown royalties, with retroactive effect to January 1, 1946.[12]

▸ **Tunisia.** The "Syndicat d' Etudes et Recherches Petrolieres" is drilling with two new rigs, purchased in the United States. Two foreign companies are planning a geological survey and a drilling program in the Central Tunisia.[7]

▸ **Turkey.** The government oil company has been vastly encouraged by the best well yet drilled on the Ramandag structure. It is said to produce about 300 to 400 bbl 15° oil daily from 4348 ft. A wildcat in the Tigris valley reports another strike.

▸ **Uganda.** (See Congo.)

▸ **Uruguay.** At present there is no production of crude oil in Uruguay. The government company ANCAP (Administración Nacional de Combustibles, Alcohol y Portland) will shortly start an exploration program, complementary to existing geological studies.

[11]Report from Compania Espanola de Petroleos.

†Report of Statens Branslekommission.

[12]Report from The Petroleum Association of Trinidad.

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The only refinery in the country, also operated by ANCAP, is running 15,000 bbl per day of crude oil imported from Peru, Ecuador, Venezuela, and Saudi Arabia. Plans for enlarging facilities include a 6500-bbl topping unit (design and supply of materials awarded to Foster Wheeler Corporation) and a plant for the production of LP gas. The new topping plant is expected to be in operation in the second half of 1949.[13]

Venezuela. Output by the 14 producing companies operating in Venezuela has moved up 15 per cent higher than last year, going to about 1 1/3 million bbl a day, second only to U. S. in world output.

Head of the government's petroleum agency announced that no new concessions would be granted but that those now in effect covering one-third of the country's area, would be fully respected. Companies with an interest in Venezuelan concessions include: Standard Jersey and Shell (which together control 80 per cent of production), Gulf, Socony-Vacuum, Sinclair, Texas, Phillips, and others. Large world demand has brought extensive development.

Phillips. Two drilling rigs and one work-over rig of Phillips Petroleum Company are now in operation in Venezuela. One rig is on a wildcat well north of the Toco-Santa Ana-San Joaquin trend. The other is on development work in the Mata Grande Field in the State of Monagas.

The company has 18 wells producing on this tract at the present time. All concessions have been covered by geological and geophysical methods and some exploration holes have been drilled.

Sinclair. Venezuelan operating companies of Sinclair Oil Corporation and affiliates hold approximately 1,900,000 acres of petroleum concessions in eastern, central, and western Venezuela. Three oil and gas fields have been developed by Sinclair Oil & Refining Company (Compania Consolidada de Petroleo) in the state of Monagas in Venezuela, namely Santa Barbara, Muri and Travieso. To date it has drilled a total of 218 wells, of which 17 were dry, 5 were gas and 196 were oil wells. Since August 1943 it has produced from these fields approximately 46,500,000 bbl of crude. At the present time it is drilling one wildcat in the State of Guaric. Extensive seismograph surveys on the company's undeveloped concessions, as well as producing wells on adjacent acreage, indicate several locations for additional exploratory wells.

Sinclair and Venezuela Petroleum Company (Sinclair) also own a 7 per cent overriding royalty on 5207 acres in the Maracaibo area, 2662 acres of which at the present time are producing. Venezuela Petroleum Company's share of production from these concessions for the first seven months of 1948 totaled 507,795 bbl of crude.

Sinclair Oil and Refining Company operates its own 12-in. pipe line from its pump station at the Santa Barbara field to the sea coast at Puerto de la Cruz, approximately 100 miles, and at Puerto de la Cruz, a deep water terminal. It has approximately 1,150,000 bbl of storage capacity in service in the field and at its terminal. Large permanent camps have been constructed both at the terminal and at Santa Barbara field headquarters in the State of Monagas, including houses for laborers and employes, a hospital and first-aid stations, commissaries, machine shops, garages, etc. At Santa Barbara, the company completed and has in operation modern pressure maintenance and natural gasoline extraction plants of 30,000 cu ft daily capacity, to maintain pressure in the Santa Barbara field and to produce gasoline, and diesel oil required in the company's operations.

Creole Petroleum. The largest Venezuelan producer is Creole, a

[13]Report from Administracion Nacional de Combustibles Alcohol y Portland.

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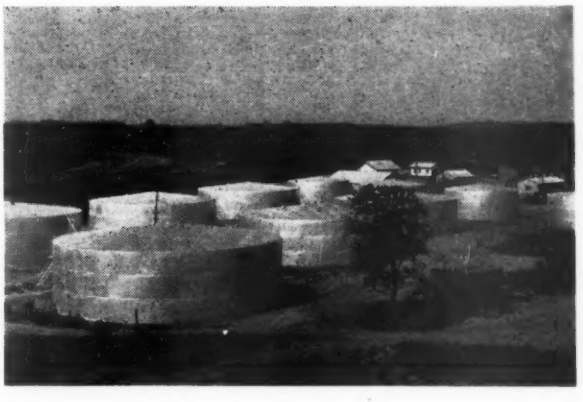

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Standard Jersey affiliate, which produced 29 per cent of the country's total crude oil. The Creole 60,000-bbl refinery at Amuay Bay is under construction with contract for completion in 1952. The design has been changed from a refinery principally for gasoline to one that will make more of the heavier oils.

The 24-in. and 26-in. medium crude line from Bolivar Coastal fields to Amuay, 145 miles, is being built.

Shell. The Punta Cardon refinery, which will handle 40,000 bbl of crude a day, is expected to begin operations next year and to be completed in 1950. The company increased capacity of its Catia La Mar-Boqueron pipe line to take care of the increased Caracas demand for motor fuel.

Atlantic Refining. After the discovery wells were completed by Venezuelan Atlantic Refining Company at Tucupido, State of Guarico, and Pelayo, State of Anzoategui, a number of development and exploratory test wells were drilled in each area. These operations were conducted on the properties that are now jointly owned by Atlantic and Pancoastal Oil Company, C. A., assignee of Pantepec. The development drilling at Tucupido resulted in completion of many additional producers. An 11-mile, 8-in. pipe line has been constructed from the Tucupido field to connect with the trunk line of the Texas and Mercedes companies to seaboard near Puerto La Cruz. The first delivery of Tucupido oil to seaboard through these pipe line facilities was made in September, 1948. Additional producing wells have also been drilled at Pelayo but this production does not as yet have pipeline outlet.

Venezuelan Atlantic Refining Company also completed a satisfactory producing well on its wholly-owned Saban-2 concession in the State of Guarico, a short distance south of the Tucupido area. Exploratory and development drilling is being conducted in this area. During the past year, Atlantic has drilled test wells in other areas in eastern Venezuela but with negative results. Geological and geophysical work is being continued.

Texas Petroleum Company. In western Venezuela, Raban 2 was completed for a light producer of oil in the Mara field. The two wells are currently producing about 5200 bbl per day. Raban wells 3, 4, and 5 are currently drilling in attempts to extend the productive area to the north and east.

In eastern Venezuela, 15 producing wells were added to the Tucupido area for a total of 31, which are now producing 5300 bbl per day, while four wells at Rincon Largo continue producing 2100 bbl per day. Sotil No. 1 wildcat was abandoned at 11,065 ft and Texas No. 3 was drilling around 4000 ft in Delta Amacuro.

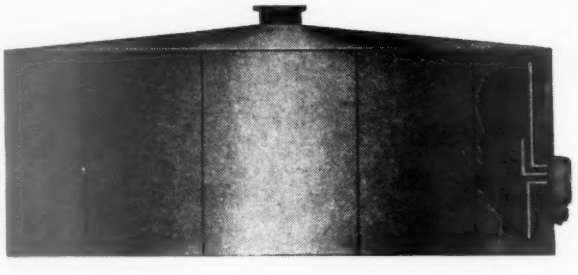
Mercedes Oil Company. During the past 12 months, 55 oil wells were completed in the Mercedes and Palacio fields for a total of 95 oil producers. After a series of tests, the production was being built up, increasing to slightly over 10,000 bbl per day.

Construction of a 16-in. pipe line from Guasimito to Pamatacual, a distance of 158 miles, was begun in December and completed in June, 1948. The first shipment of oil from the Pamatacual terminal near Puerto La Cruz was made in July.

Of the wildcats, Mercedes No. 43, later called Guavinita No. 1, discovered a new producing area five miles northwest of West Palacio field. The well flowed 216 bbl per day through a 3/16-in. choke. Placer No. 1 blew out in October, 1947, while drilling below 6000 ft, and after producing a large volume of dry gas was brought under control 18 days later. It is now being deepened into the Cretaceous beds.

▸ **Yugoslavia.** The petroleum industry has been nationalized and goal set for 3,150,000 bbl in 1951. Best estimates give present production at 375,000 bbl a year.

* * *



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(1) Hydraulic drives

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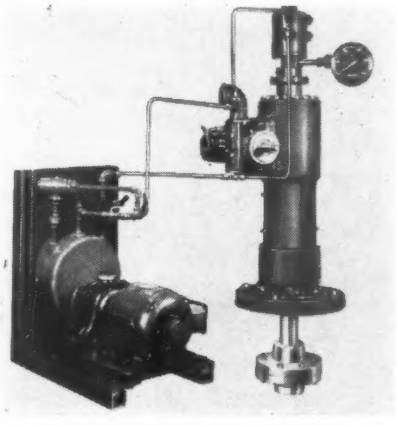
The Rockwell hydraulic system uses pumps and motors of the well-known Rotocycle design as the hydraulically coupled activating mediums. The qualifications of Rotocycle construction for extremely high efficiency, large volume displacement, quiet, nonpulsating operation, and durability have been field proved for many years. Motors may be remotely located from pumps and the hydraulic circuit can be arranged so that several motors are supplied with fluid pressure from one central pumping source.

Of particular interest is the "Hydro-syn" governing system that is used to maintain a constant predetermined speed. The desired speed is first set by adjusting the position of a main circuit control valve on a graduated dial. This speed is then maintained through the functioning of a separate hydraulic control circuit that operates on the constant pressure differential principle through a pilot valve. Should this constant pressure differential be upset for any reason, the pilot valve instantly reacts to reposition the proportioning of fluid to the main hydraulic motor. The "Hydro-syn" system can be used to maintain any predetermined condition of speed, torque, pressure, volume, or liquid level.



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Rockwell variable speed hydraulic drives can be supplied in speed ranges up to 5000 rpm and in ratings for fractional to 125 hp or greater.

(2) Multi-record Dynalog

Shrouded in deep secrecy during the long period of its development and field-testing, the Multi-Record Dynalog Electronic Recorder of The Foxboro Company was exhibited for the first time at the recent I.S.A. Instrument Show in Philadelphia, where it excited great interest. It is a high-speed instrument, completely electronic in principle, making from one to six different records on one circular chart, the records being of colored dots so closely spaced as to make virtually continuous lines. The recorder has only one measuring system, either resistance bulb or EMF type, but a positive-acting switching unit automatically brings the vari-colored pens into recording position at 6-sec intervals, in any sequence desired. The sequence and number of points may be changed at will, quite easily. Complete color-coding prevents possible mismating of circuits and pens.

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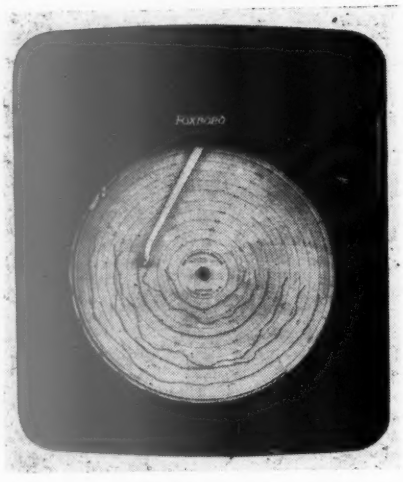

sign of the recorder is the use of its Rotacolor pen wheel holding the six recording pens, which are magnetically selected in turn and held in recording position by a single pen arm. Except for its unique recording mechanism, the recorder conforms to the design and construction which is standard for other Foxboro Dynalog (electronic) instruments, and, like these, the multi-record recorder may be used for measurement of temperature, pressure, humidity, liquid level, pH, conductivity, speed, and other process variables. A special "dry ink" insures clean recording, and the instrument will operate continuously for several weeks without need of re-inking.

(3) Soluble plugs

Development of a 3-in. soluble plug for use in cleaning paraffin out of surface production lines is announced by Kobe, Inc. Five sizes of plugs are now available for paraffin removal: 1 in., 1¼ in., 2 in., 2½ in., and 3 in.

The manufacture of the king size plug is the result of an industry-wide demand for an inexpensive and simple soluble "go-devil" for use in surface lines.

On hydraulically equipped leases, soluble plugs simplify paraffin removal. All that is required, when paraffin forms in a line, is to insert a plug and push it through the line with oil pressure. Kobe plugs have sufficient rigidity to scrape the wax off the walls of the pipe fittings. It is not necessary to retrieve the plugs that are inserted in the line. They are designed to dissolve after a short period of submergence in oil.

Soluble plugs are now in use throughout the industry. On leases where wells are not hydraulically operated, it is necessary to develop a method by which pressure can be placed behind the plug with sufficient force to push it through the line.

(4) Hydro-Sheave Drive

The Twin Disc Clutch Company announces a new hydraulic power transmission unit—the Hydro-Sheave Drive. This is a hydraulic-conversion device for small electric motors and internal-combustion engines. The basis of the new unit is a Twin Disc small hydraulic coupling, long successful in smothering shocks and smoothing the flow of power from motors or engines in the ¾ to 25 hp range.

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V-belt sheaves, the new Hydro-Sheave Drive package consists of a small Twin Disc hydraulic coupling, with a sleeved shaft that slides directly over the output shaft of any small electric motor or engine.

In the Twin Disc Hydro-Sheave Drive, oil is the only medium of power transmission. Incoming power from the electric motor or internal-combustion engine rotates the hydraulic coupling inner member, the blades of which throw a continuous stream of oil against the vanes of the coupling outer member, or housing. The rotation of the housing with its attached sheave or sprocket provides a steady, uninterrupted flow of power to the driven equipment. A sudden shock, or overload, from the driven equipment, is absorbed by the fluid in the hydraulic coupling and never reaches the motor or engine. Conversely, torsional vibrations from the engine or motor are effectively dampened out by the fluid and never reach the driven equipment.

Among the many industrial applications to which the Twin Disc Hydro-Sheave Drive may be applied are cranes, hoists, conveyors, elevators, winches, fans, blowers, compressors, machine tools, test stands, and on equipment in the rubber, textile, metal, paper, and food industries.

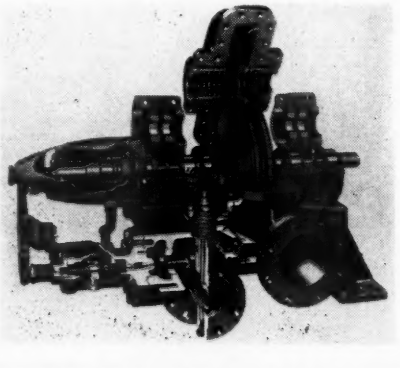
(5) Typee turbine

A new all-weather general purpose turbine for driving industrial pumps, fans, blowers, compressors, paper machinery, and small generators, the Typee, has been announced by the Westinghouse Electric Corporation. A choice of three wheel sizes, 16, 20, and 25 in., permits Typee turbines to be applied over a range of 5 to 1500-hp with steam conditions up to 600 psig at 750 F, and speeds of 1000 to 7000 rpm. Equipped with heavy duty parts the turbine will operate at 1500 psig at 950 F. Many parts are interchangeable between wheel sizes.

Efficient combination felt and labyrinth bearing seals protect the turbine's lubricating system from contamination so that neither torrential rain nor the presence of abrasive dust will affect its operation. Corrosion resistant materials are used liberally throughout.

An overspeed trip simultaneously closes the governor valve and a heavy butterfly valve at a predetermined speed. Improved free-expansion center line support is arranged so that pipe line reaction is transmitted to the foundation.

The basic turbine is equipped with a shaft type governor, mounted in a rugged casing that completely protects the governor assembly and shaft end. The entire governor assembly can be replaced without disturbing the shaft. It is interchangeable between wheel sizes. Typee turbines may be equipped with special wide speed range governors where required.



with Clark Compressors

for New TXL and WASSON No. 2 Gasoline Absorption Plants

The Shell Oil Company's new TXL plant in Ector County, Texas, duplicates the operating conditions of Shell's Wasson No. 1 and No. 2 gasoline absorption plants in Yoakum County, Texas.

In these modern plants, 34,400 brake horsepower of Clark Right Angle Gas Engine Driven Compressors take the gas in from the field at pressures between atmosphere and 7 psig and compress it in two stages to a final discharge pressure of 205 psig. At this final pressure, the hydrocarbon gas is processed in highly efficient absorber units where the gasoline is extracted.

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Shell's new TXL Plant in Ector County, Texas, showing compressor house in foreground containing eleven 800 BHP Right Angl

CLARK

ONE OF THE DRESSER INDUSTRIES

SETS THE PACE IN COMPRESSOR PROGRESS

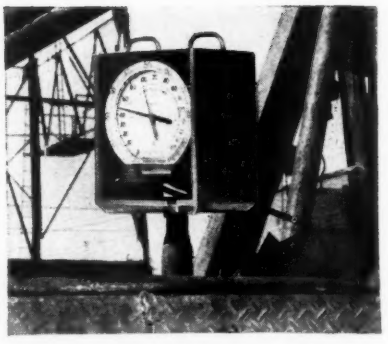
(6) Weight indicator

The Martin-Decker production model Clipper Sealtite weight indicator is ideal for small rigs, production hoists, etc., according to the manufacturer. It is only 14 in. by 17 in. by 12 in.

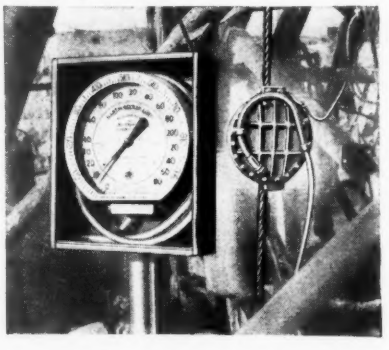
In the past, Toolpusher Model or unit type weight indicators have been preferred for such services as small drilling rigs, production hoists, etc., because they were easy to install and move; however, the dead line in truck mounted production and drilling units is usually too close to the mast leg to accommodate the Toolpusher type without danger of damage resulting from dead line vibration and whip, it is asserted.

Then, too, the dead line is not always in the best position for convenient location of the weight indicator gauge. Toolpusher types are more difficult to read due to dead line whip, vibration, reflection from lights or sun, and weather conditions. it is stated.

When attached to the mast as a permanent instrument, these weight indicators remain in place when the mast is lowered or the rig moved, thus becoming an integral part of the drilling or production unit. The gauge, hose, and diaphragm are permanently sealed and ready for installation on the rig. There is no pumping or bleeding and the first installation is the last. The gauge is mounted in the most convenient position on a permanent bracket or post. The diaphragm is attached to the dead line and remains there.



The Portable Model Clipper Sealtite. Ideal for any small space. Note convenience of handles. Can be installed permanently if desired.



The Clipper Sealtite permanently installed on a trailer mounted rig. Lowering the mast and moving in no way interferes with this installation.

When used as a portable model, production Clipper Sealtites can be moved easily and quickly from rig to rig at a moment's notice. Just remove weight diaphragm from dead line, unscrew collar at bottom of gauge box from nipple going into derrick floor, coil high-pressure hoses in box compartment provided, pick up, load in car, and move to next location. It weighs only 115 lb complete (52 kilos).

(7) New Cummins diesel

A new Cummins diesel engine, based on the well-known "Model H," yet developing 10 per cent more horsepower, was placed in production last month by Cummins Engine Company, Inc. The new Cummins diesel, designated the HR-600 engine, continues the Cummins trend toward "more

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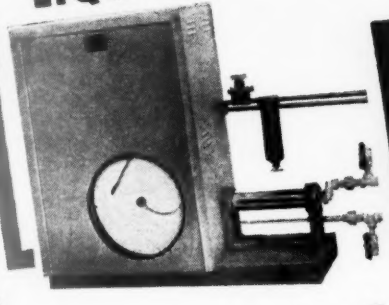
RECORDING CONTROLLING* LIQUID GRAVITOMETER



CONTROLS BLENDING OF TWO OR MORE FINISHED PRODUCTS

. . . for Pipelines, Refineries, Chemical Plants, etc.

This new instrument serves to determine and record the specific gravity of liquids in the same manner as the standard Arcco-Anubis liquid gravitometer.

*In addition to these features, a controlling mechanism is provided, which may be pre-set to operate the pipe line, refinery, still and plant control valves to any specific gravity range required in blending two or more finished products.

Temperature corrected, this extremely accurate instrument is adaptable to high pressures and is available with internal parts of stainless steel for use with corrosive liquids. Send for bulletin No. 111 A.

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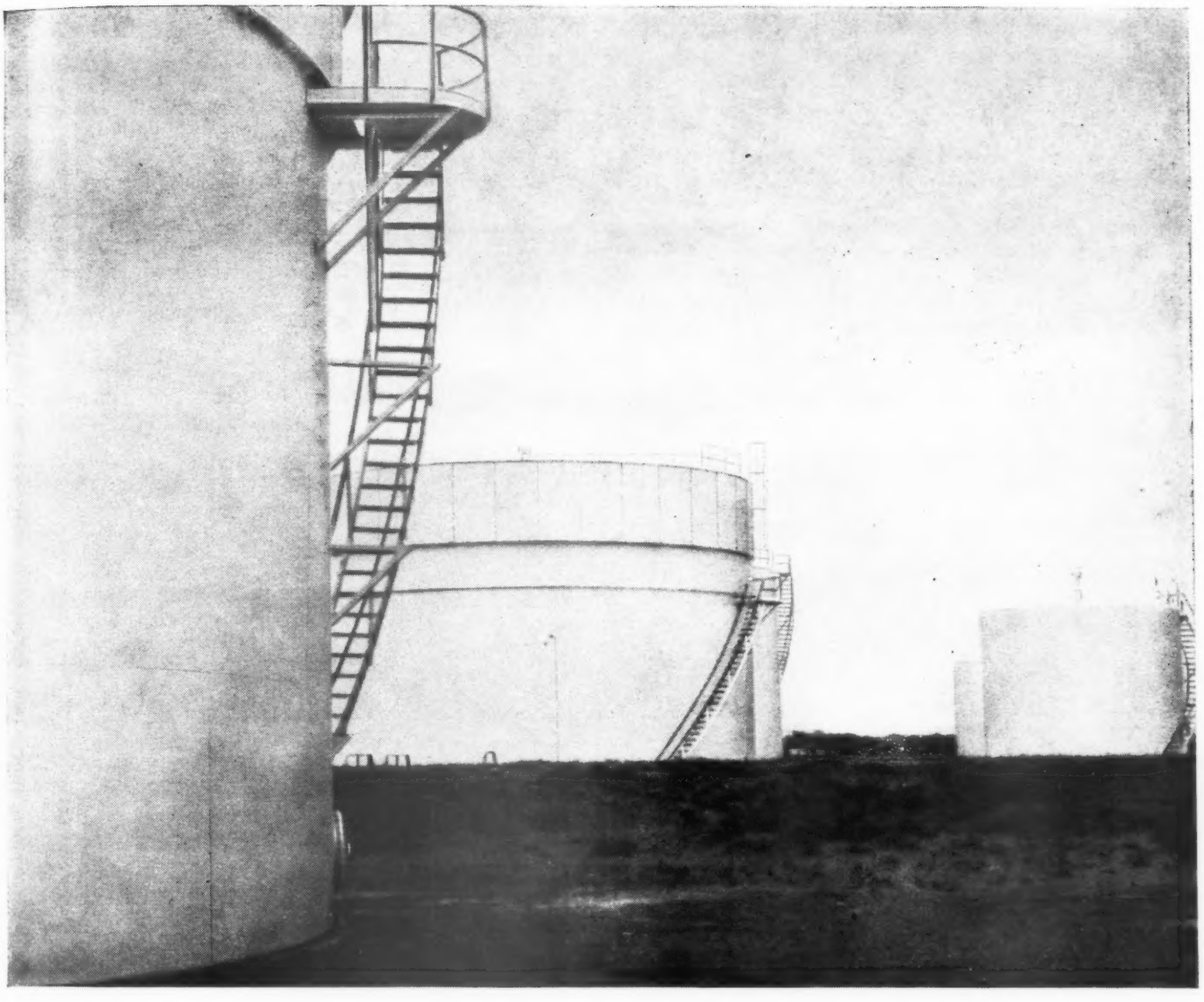

VAPORS "RAISE THE ROOF"

It happens every day. As temperatures increase, the vapors lying over petroleum products in storage expand, raising the Graver Expansion Roof. As temperatures decrease, the vapors contract and the roof descends. It's as simple as that, with the vapors always under control. There's no venting to the atmosphere and no intake of moisture-laden air.

This control of vapors prevents breathing and filling losses in either single or multiple tank installations. In the latter, a manifold system connects several cone roof tanks to one or more Expansion Roof Tanks. Of particular value to the multiple tank set-up, is the pressure operated relief valve. Should one Expansion Roof reach the limit of its travel, it does not vent until all roofs in the system have also reached their limits and the pressure throughout the system is equalized.

Write today for details on the advantages of letting vapors "raise the roof."

FABRICATED PLATE DIVISION

GRAVER TANK & MFG. CO., INC.

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Graver offers a complete service to the petroleum industry including Expansion Roof Tanks, Floating Roof Tanks and pressure vessels. In addition, Graver is prepared to furnish specialized steel plate work such as fractionating columns and class one vessels as well as stainless and alloy fabrication; water conditioning equipment of all types; and through the Graver Construction Co., is prepared to handle all types of petroleum and chemical construction work.

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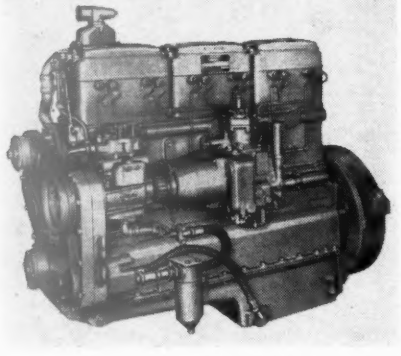
power per pound" initiated with the introduction of the H-600 engine in 1932 and continued with the NH-600 engine four years ago.

The HR-600 engine develops 165 hp (maximum) at 1800 rpm, with 5⅛-in. bore and 6-in. stroke. Piston displacement is 743 cu in. Like all Cummins diesels, the HR-600 is 4-stroke cycle and has the exclusive Cummins fuel system.

The new HR-600 is available in an automotive model, HRB-600; three industrial models, HRBI-600, HRI-600, and HRP-600, and a marine model, HRM-600. Model HRBI-600 is the basic industrial model, Model HRI-600 is equipped with instrument



panel and trunnion support base, and Model HRP-600 is an enclosed power unit with structural steel base, clutch power take-off, radiator, fan, engine hood, and fuel tank.

Field conversion to HR-600 from H-600 can be made by Cummins dealers. Steps involved include boring the present block and installing HR-600 pistons and liners and the optional installation of the new increased-flow lubricating system and continuous groove bearings.

(8) Fluid sampler

An innovation has been added to the McCullough gun tester in the form of a fluid sampler. This new and valuable device provides a sample of the last fluid to come through the valve in the tester before the tester is closed. The sampling device is then brought to the surface where the fluid is observed and tested before starting out of the hole with the testing tool.

When this sampling device is used in conjunction with the McCullough surface-recording pressure bomb equipment, complete information regarding the test is provided within a few minutes after the test is completed.

The manner in which the sampler is employed makes it possible to obtain valuable information in less time, due to the fact that an actual sample of the fluid is made available without requiring any extra time or effort on the part of the operator; several samples may be procured during a test, if desired.

Before the advent of this new sampling device, it was necessary to wait until the tester itself was pulled from the hole before information pertinent to the nature of the fluid that had entered the operating string could be obtained.

This new combination of McCullough gun tester with fluid sampler and surface recording pressure bomb equipment is run as a unit and in the following manner:

The gun perforator and a pressure sensitive element is joined to the bottom of the testing tool or packer in such a manner that the pressure sensitive element is exposed at all times to well pressures. An electric conductor element is so arranged through the tester as to connect with the pressure sensitive element at the bottom of the tester and provide continuity to the top sub above the tester. The assembly is then run into the well on an operating string of tubing or drill pipe to a point where the test is to be made. Then the sinker bar and fluid sampling device is run in through the operating string. When it reaches the top of the tester an electric connector in the bottom of the sampling chamber mates with an electric connection in the top sub of the testing tool.

As soon as contact is made, a recording instrument at the surface immediately indicates the hydrostatic pressure in the well. The gun perforator is fired in the usual manner by pressing the buttons in the shooting panel. The recorder instantly shows that the gun has been fired and continues to draw a curve of the hydrostatic head in the well.

After the gun is fired, the operating string is moved upward a few feet and the tester is set, excluding the original hydrostatic pressure from the bomb and exposing the bomb to the rock or formation pressure below the packer.

The inlet valve in the tester is then opened. If the test is dry, there will be little or no change in pressure shown on the chart at the surface, as time passes; but if wet, the surface recorder will indicate a continuous increase of pressure until the column of fluid rises inside the operating string to a point where the pressure created by the fluid head equals the rock pressure and the column becomes static, or until the fluid flows over the top of the operating string.

When the test is completed the inlet valve is closed and the sampling chamber is actuated by upward movement of the line at which time the sample of the bottommost fluid is trapped and brought to the surface where it may be tested and observed before starting out of the hole with the testing tool.

The McCullough fluid sampler is available with the McCullough surface recording pressure bomb equipment at no added cost to the oil operator.

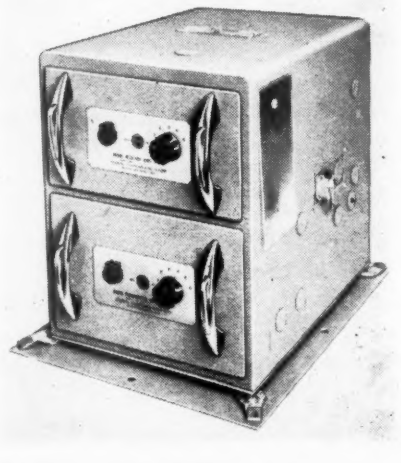
(9) Mobile communications

Instantaneous voice communications between supervisory personnel and service vehicles — extremely valuable in routine dispatching, a tremendous asset in emergencies — can now be achieved by utilities, water works, pipe lines, and road construction companies through the use of FM mobile radio equipment developed by Federal Telephone and Radio Corporation, manufacturing associate of International Telephone and Telegraph Corporation.

"They work better together because they can talk together" is a fact that has already made the use of mobile radio a must in many industries. Rerouting and dispatching instructions can be immediately relayed to all necessary personnel, information regarding traffic conditions can be supplied to all drivers from "on the spot" accounts, all vehicles can be coordinated into a smooth running team in periods of emergency. These are some of the time and money saving advantages of Federal's FM mobile radio.

A single dust-proof, shock mounted metal case, 9⅝ in. wide, 11⅞ in. high, and 13½ in. long, houses both the transmitter and receiver. With no connecting cables between units, the space required for installation has been reduced to a minimum.

Another feature of Federal's mobile equipment is its "desk drawer" accessibility plus interchangeability wherein either receiver or transmitter can be replaced in a matter of minutes. A unit is removed by simply grasping both handles, which releases the spring



loaded latch mechanism, and permits withdrawal of the chassis. All connections are made automatically when the unit is replaced and self locked under spring tension. No screws, hold-down bolts, or other means of fastening are used for holding down the chassis. Mobile units can also be supplied in "weather proof" housing for external installation.

(10) Motorgears

Fairbanks, Morse and Company announce that their axial air gap motor, which caused such a sensation in the electric motor industry 18 months ago when this unique type of "pancake" motor was introduced, is now available as a motor reducer.

The outstanding features of the axial air gap motor are space and weight reduction, the motor being less than half the size of the conventional type motor and weighing less by approximately one-third, yet retaining all the necessary characteristics of sturdiness and power requirements.

Available in ratings from $\frac{3}{4}$ to 10 hp, these units are symmetrical in design with no separate right-hand or left-hand assemblies. The motor may also be removed from the gear housing and run separately.

This new Motorgear employs two ratios of single helical gears with hardened and accurately shaved teeth arranged in simple gear trains, resulting in the highest efficiency available in the mechanical transmission of power, according to the manufacturer. It does not employ planetary gearing of any kind.

Another feature of the new Motorgear is that the motor and gear shafts are parallel, with the centerline of the motor coinciding with the centerline of the low speed shaft. The motor shaft rotates on ball bearings, while the gear shafts are mounted on tapered roller bearings. The high speed pinion, mounted on the motor shaft extension close to a double row ball bearing, reduces deflection of this overhung pinion to a negligible minimum. The bearings on the low speed shaft are over-size to allow for a generous amount of outboard pull from a sprocket, gear or pulley that may be mounted on this shaft.

The gear housing is a sturdy one-piece casting with all four feet included in the same casting. Consequently there are no joints between the feet that might have a tendency to leak from the strain of tightening down the foot bolts. Being finished together on the same casting, the bottom of the four feet are always in line.

The new Motorgear is suitable for horizontal mounting, preferably on a level floor, but provisions can be made for wall, ceiling or angle mounting, provided the shafts remain horizontal.

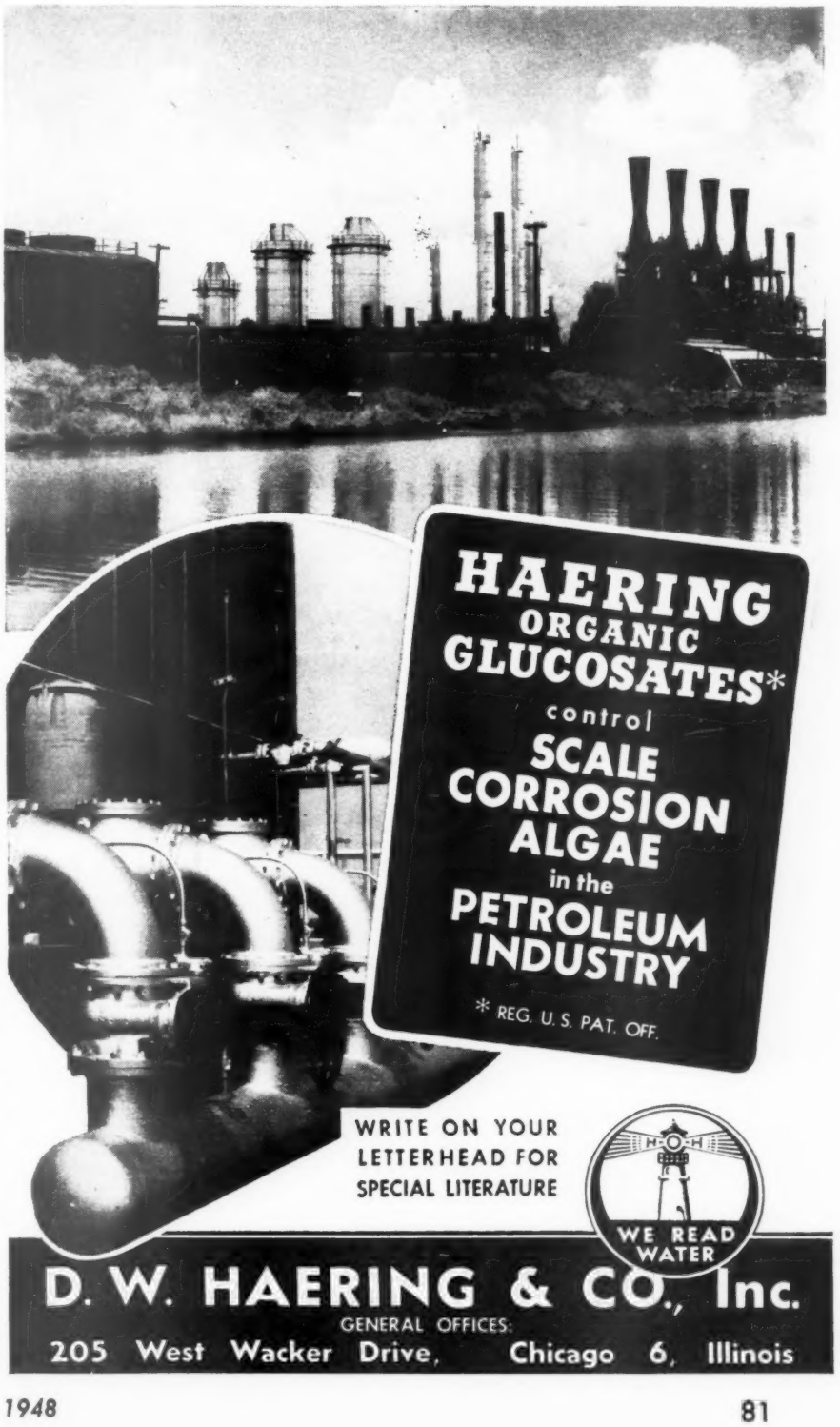
(11) Vertical air compressors

The Grimes Company has developed a vertical air compressor that is outstanding for the floor space it saves the user. The space-saving feature has been developed by designing the unit with the tank upright and the motor and air compressor unit mounted on top.

Three models have been developed. They are: The model 25-V, which has a 20-gal tank with a $1\frac{1}{2}$ cu ft per min air displacement; the model 50-V, which has a 30-gal tank and displaces 2.7 cu ft of air per min; and the model 75-V with a 30-gal tank that displaces 4.07 cu ft of air per min.

The model 25-V requires only 20 in. diam floor space and the other two models require only 24 in. diam. All three units are equipped with a single phase motor that operates on either 110 or 220 volts. The model 25-V has a $\frac{1}{4}$-hp motor, the 50-V a $\frac{1}{2}$-hp motor, and the 75-V a $\frac{3}{4}$-hp motor.

These compressors are made from

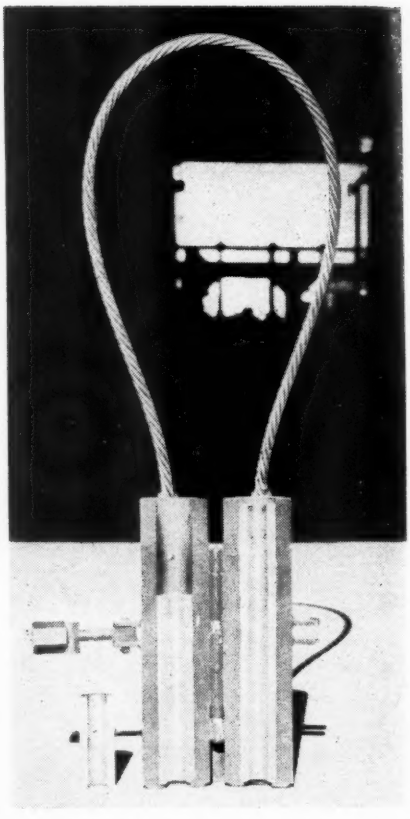


high quality steel with electric welded construction. They have withstood a 400 psi hydrostatic test and have a 200 psi working pressure. Each is equipped with an automatic pop off valve and adjustable automatic switch.

(12) Wire line tightener

The Sunshine Iron Works line tightener is a new and improved time and accident saver. It is of simplified clamp design, with two-hinged half-shells. These shells house interchangeable brass liners through which the drilling line passes as it is being spooled. As a safety device, it eliminates the use of the catline while spooling the line after a cut is made. As a time saver, it permits free and easy drum spooling of the line. Strung free from the derrick a few feet above the drum, the SIW line tightener swings back and forth as line is spooled onto the drum, preventing overlap and kinking.

Clamps are 18 in. long and weigh approximately 68 lb. An adjustable hasp permits quick opening and closing of the halves, and a 2-ft, hip-high cable loop serves as an easy means of swinging it in the derrick. A flange at the lower end of each half holds the liners in position. An extra-long hinge connects both halves of the SIW line tightener.



When closed, the SIW line tightener grips running line firmly to permit tight spooling on the drum. These long wearing liners will run approximately 6000 ft of line before wearing out, and are supplied by the manufacturer in three standard line sizes: 1 in., 1⅛ in., and 1¼ in.

(13) Turbine pump

A new turbine pump for small diameter deep wells, which is capable of developing water capacities up to 5000 gal per hr from depths as great as 200 ft, is announced by the Peerless Pump Division of the Food Machinery and Chemical Corporation. This new pump, designated as the Peerless Champion, fills the gap in water production from deep wells 4 in. in diam and larger, which is often found between "domestic" water systems and the larger types of deep well turbine pumps.

The Peerless Champion is an open line shaft pump; bowl and shaft bearings are lubricated by the well's own water. No oil is used underground. Semi-open impellers, streamlined procelain-enameled bowl sections, rubber bearings all contribute to its smooth water lifting with minimum losses due to turbulence. All shafting is stainless steel. Utilization of long cutless fluted rubber shaft bearings, spaced every 5 ft, are resistant to normal sand and

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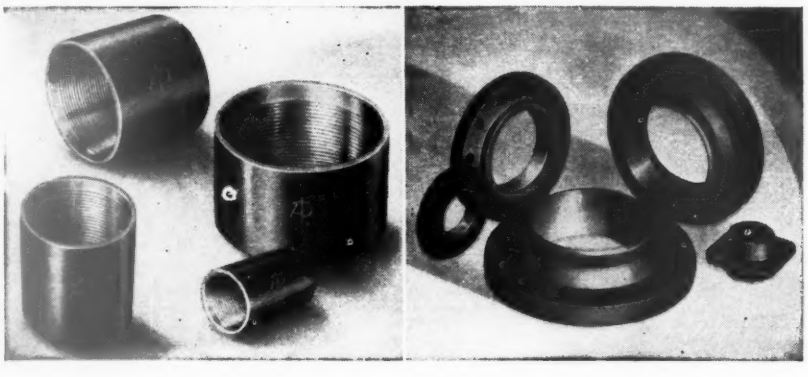

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Harrisburg Seamless Steel Couplings owe their superiority to almost thirty years experience plus carefully controlled inspection. The accuracy of the threads in a Harrisburg Coupling assures a perfect leak-proof joint. Available in all sizes and types.

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abrasive conditions. Impellers are die cast bronze, hand finished and balanced.

The Champion is ideally adapted to a vertical tank pneumatic pressure system, it is stated, being capable of developing pressures up to 90 psi or more. In addition to its application to water development from wells for the moderate gallonage requirements of commercial, light industrial and agricultural uses, it can be applied, close-coupled, to short settings for developing water from pits and sumps for supplying water for air conditioning, cooling tower service, and other similar services where amounts of solids in suspension is negligible. With slight modifications the Champion may be applied to industrial process work, chemical plants, and similar services.

All types of driving arrangements are available for the Champion: Standard direct-connected electric motor (1 to 10 hp); right angle geared drive for use with horizontal engines; multiple V-belt or flat belt pulley.

(14) Light-weight welder

A new light-weight, engine-driven, d-c welder, designed for a wide range of general applications, has been announced by General Electric's Welding Equipment Division. Weighing only 660 lb for a maximum of 250 amp of welding current, the new welder can be easily transported on a pick-up truck, leaving ample truck capacity for other equipment.

It is powered by a Wisconsin VF-4 air-cooled engine, speed-ratio-coupled by a steel-core V-belt drive to a G-E Type WD-3200 generator with 50 per cent duty cycle. A fully calibrated dual control permits the accurate setting of a desired welding current before the arc is struck.

(15) Holiday detector

Petroleum Instrument Company has developed a new motor-driven, mobile holiday detector with a power output nearly 50 times greater than conventional dry or storage battery sets, according to the manufacturer. The 500 watt, 3000-30,000 volt output unit may be controlled and regulated for any condition, according to the manufacturer, providing ample power to detect the minute holidays that are passed up by the lower power units.

As illustrated, the Model "B" holiday detector is a self-contained unit and is gasoline motor driven. It is mounted on a sturdy 4-wheel truck that may be easily moved along the line with the electrode. The unit is designed to operate directly behind the coating and wrapping machine as it travels along the pipe, or it may be operated at a distance from the machine. The coil spring electrode rolls on the wrapping head of the machine. The electrode contains lubricant that keeps a film of grease on the outside of the spring, thus preventing the soft coating from adhering or sticking to the spring.

The gasoline-driven high-voltage motor generator set is generally pulled behind the tar pot feeding the coating and wrapping machine, which allows inspection of the coating job immediately after it is wrapped.

According to the manufacturer, the Model "B" holiday detectors are available on rental service, or sold outright, if desired.

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"Extra" Heavy-Duty
Roller Bearings
for the toughest anti-Friction jobs

Here is a "super" bearing designed especially for *super, heavy-duty* service. Its simple construction, absolute precision and tremendous strength assure smooth, dependable performance in the heaviest machinery under the most difficult operating conditions. Complete technical data furnished without obligation. Write.

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trade literature

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(16) Rotary pumps and vacuum tight valves

Kinney Manufacturing Company has issued two new bulletins. Bulletin L48 is on Kinney rotary liquid pumps and Bulletin 2448 on vacuum tight valves. Both publications are well illustrated and fully describe their subject.

(17) Bulletin describes SK Rotameters

A new 4-page folder, Bulletin 18-RA, pictures and briefly describes the various types of Rotameters and flow indicators manufactured by Schutte and Koerting Company. Specifically designed to assist engineers in determining the type meter best suited for individual requirements, the folder lists each type of Universal Rotameter, Recording Rotameter, Special Rotameter and Flow Indicator offered and refers by number to the SK bulletin in which complete details are given.

Captions accompanying each photo indicate the principal applications for which the instrument is designed and list the available sizes.

(18) Metallizing equipment

The Metallizing Engineering Company, Inc. announces a new catalog of its complete line of metallizing equipment and supplies. "The Best of Everything for Metallizing" is a complete catalog of metallizing equipment, accessories, and supplies. In it will be found metallizing guns for every purpose, air and gas controls, spray booths and dust collectors, blast machines and nozzles, and air compressors to give clean, dry air. Each piece of equipment is clearly illustrated and described. There is also a description of each of the special Metco metallizing wires.

(19) Liquid level gauge

Brown Instrumentation Data Sheet No. 10.4-1 lists various applications and explains the operation of the "Gagetron," a product of Engineering Laboratories Inc. Different methods of liquid or interface level control and measurement, using a Brown ElectroniK controller are fully explained. The Brown Instrument Company issues this release.

(20) Electrode and preheat chart

Recommended arc welding electrodes for joining like or dissimilar metals are charted in Bulletin W-19, published by Ampco Metal, Inc. The new chart lists 31 alloys and shows which of five bronze electrodes is best suited for the welding application together with proper preheat for each joining application. The metals listed cover copper, copper-base, and iron-base alloys.

(21) Celectray potentiometer pyrometers

A revised 36-page catalog, number 1101-J, has been published by the C. J. Tagliabue Corporation (N. J.), manufacturer of indicating, recording, and controlling instruments for temperature and pressure. The catalog illustrates and describes in detail Tagliabue's complete line of Celectray potentiometer pyrometers, which are distinguished by their construction, embodying a phototube, a beam of light, and a mirror galvanometer. All models of these indicating, recording, and controlling pyrometers employ the Celectray principle of operation to achieve accuracy and almost instantaneous response.

(22) Carrier telephone, telegraph

A comprehensive listing of the carrier systems engineered and manufactured by Lenkurt Electric Company is provided in a new 12-page folder, Form CX42. This publication gives brief descriptions of: Type 32, 3½-channel wire line carrier; Type 12 and 17, long-line single-channel carrier; Type 10, short-line single-channel carrier; Type 42 and 44 carrier-on-radio systems; telegraph and telemetering gear; signaling equipment for ringdown and toll dialing, and test apparatus for system maintenance.

Throughout, emphasis is on scope of available carrier equipment. More complete details on any of the systems can be obtained from individual bulletins describing each.

(23) Electric tachometers

The Metron Instrument Company announces the release of Bulletin No. 104 describing the new, low cost, electric tachometers for all installations. Several tachometer heads are shown for industrial, marine, railway, diesel, and aircraft applications and for directhead coupling from 1 rpm to 100,000 rpm.

(24) Remote control bulletin

A new 16-page Bulletin No. 800-B, describing the varied manual and automatic remote control applications of Grove Flexflo expansible tube valves has been issued by the Grove Regulator Company. Included in this manual is technical data and diagrams of typical arrangements suitable for stop valve, emergency shutoff and relief valve, liquid level control, automatic flow controllers of the liquid type, and gas type, shockless pump control, slow opening and closing check valve, and many other widely diversified uses.

(25) Long stroke hydraulic pumping

The Pelton News Letter is an interesting monthly dissertation covering all angles of long stroke hydraulic pumping, with, as might be expected, special reference to the Pelton long stroke hydraulic pumping jack. It discusses the function of such pumps, the advantages to be gained from their use under the right conditions, and the details of experience with existing installations in California and the Mid-Continent. Operation and maintenance procedures to insure the most economical results are also outlined in the letters, and they contain general information of value to anyone concerned with the economics of well pumping.

(26) Explosion-proof motors

A three-way saving in the form of lower installation, insurance and maintenance costs is claimed for Allis-Chalmers explosion-proof motors in a new 4-page bulletin released by the company.

The motor's safe, simple, and accessible construction is discernible from a sectional view that shows how ventilating air is drawn through the unit by a fan inside the end bell and evenly distributed over the stator shell without coming in contact with windings.

Allis-Chalmers explosion-proof motors are available in sizes from 1 to 250 hp and are finding widespread use, it is stated. They carry the Underwriters' label for Class I, Group D and Class II, Groups G and F locations. According to the bulletin, larger motors for hazardous locations are available in sizes to 3000 hp and larger.

(27) War on corrosion

To help industrial designers, engineers, and buyers cut the cost of important machine components and accessories, about 200 standard products for corrosive and high temperature service are listed in a new catalog by The International Nickel Company, Inc. Checked by manufacturers of each item, this new "standard specialties" catalog is the first complete compilation of products made of monel, nickel, or

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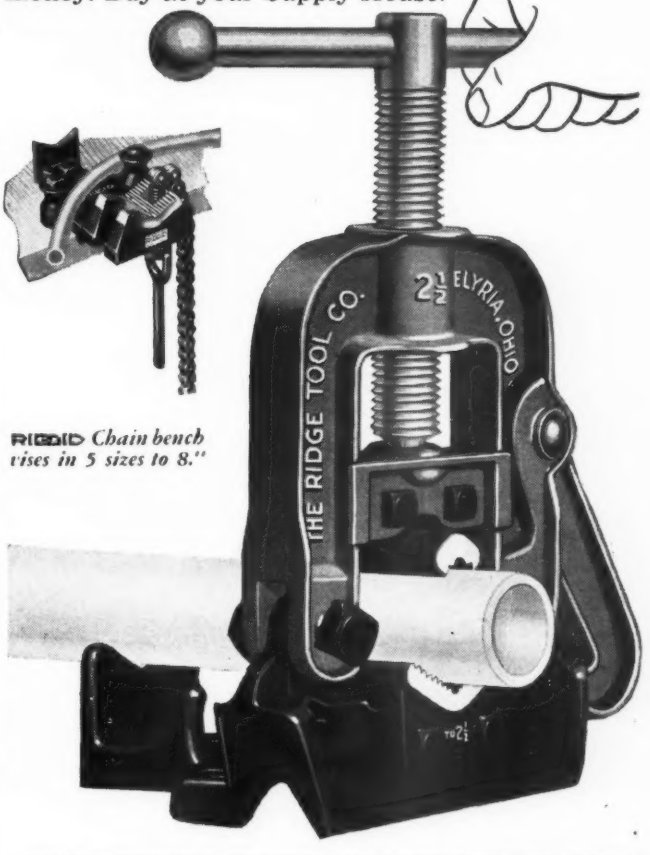

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inconel and available economically from stock or from standard designs.

Among the hundreds of "standard specialties" described and illustrated under 47 general classifications are balls, floats, nails, bolts, pickling slings and hooks, thermostat parts, thermocouple protection tubes, pipe and pipe fittings, gaskets, valves, cathodes, grease fittings, tags, woodruff keys, wire rope, and vibration isolators.

(28) Preformed wire rope

A booklet recently released by the Preformed Wire Rope Information Bureau presents wire rope in a novel and interesting manner. It is a 16-page picture story entitled "The Wonders of Wire Rope." In something of a "comic book" style it tells about the travels of a power shovel operator and his family. They see the many uses of wire rope from deep in the earth to high in the sky, see how wire rope is made, and hear the story of preformed wire rope.

In easy-reading style, this booklet tells the story of an important industrial product. It is educational and interesting, especially for men who are busy as well as for operators of equipment who do not ordinarily see literature of this kind. It is particularly well suited for reading to children.

(29) Crown and traveling blocks

A new 16-page bulletin, No. 355, superseding bulletins 258 and 259, covers eight types of National Ideal crown blocks and traveling blocks for 300-ton loads and 1¼-in. wire line. The bulletin features and illustrates design of the blocks, particularly the sheave and bearing assembly, and independent mounting of the 48-in. sheaves. General specifications are included for all types.

(30) Hardfacing alloys

A hardfacing booklet, covering the complete new line of Airco hardfacing alloys, has been published by the Air Reduction Sales Company. The 16-page, two-color, profusely illustrated booklet, which also serves as a hardfacing catalog, describes each of Airco's new alloys in complete detail. Included are data on typical uses, specifications, application technique, deposit hardness, color markings, and deposit analysis. Every page is full of helpful, authentic information on how to combat wear and increase equipment work-life.

(31) Synchronous motors

New bulletins available on bracket and pedestal-bearing types of synchronous motors have been released by Electric Machinery Manufacturing Company. Illustrated are features of fabricated steel frame, modern bearings, multi-layer insulation and new splash-proof and drip-proof protective construction. Application advantages and installation pictures are included. Bulletin 1200-PRD-175 covers low-speed (below 500 rpm) and bulletin 1100-PRD-181 covers high-speed (above 500 rpm) motors.

(32) Jacks for oil field use

Templeton, Kenly and Company, manufacturers of lever, screw, and hydraulic jacks, has issued an engineering data bulletin on its Simplex jacks for drilling, skidding, and supporting jobs in the oil field.

Designed to facilitate scores of troublesome but important tasks in today's all-important oil fields, this series of jacks is illustrated in actual use in the bulletin "Oil 48." Included in the 4-page bulletin are detailed descriptions of the No. 310A emergency jack for all-purpose lifting or lowering, and Nos. 125, 126, 127 and 135 geared jacks for heavy duty use, rigging, pulling casing, and other oil field construction work.

In addition, there is the No. 2029 riggers jack; the pull rod jack for easier pulling of broken rods on central powers or back crank units together in a straight line without kinking or damaging the rods; No. 322 cable reel jack for faster and safer paying out of rope, wire or cable on spools, reels, or drums; hydraulic jacks for faster lifting and moving of heavy loads, and journal jacks for use wherever a powerful jack of low height is needed.

Also illustrated and described in the bulletin is the new Simplex-Jenny center hole hydraulic puller for oil field work. One man operating the Jenny can pull stubborn slush pump valve seats, bushings, pistons, cylinder liners or wrist pins, it is stated.

(33) Wellhead equipment

A new 8-page bulletin, No. 328-A, has been prepared by The National Supply Company to show "How to Install—National Type B Pressure Pack Well Head Equipment." The bulletin pictures 10 installation steps with descriptive captions and shows how the complete assembly may be tested any time without disturbing the well.

The bulletin also describes and illustrates the intermediate hold-down flange, welding flange, interchangeable tubing hangers, and bit pilot, and tabulates sizes of casing flanges, ring gaskets, and bolt-studs.

(34) Pushing through the pipelines

Diesel tractors and engines equipped with the versatile accessories so necessary to the job of pipeline laying are given complete pictorial coverage in the 12-page booklet, "Pushing Through the Pipelines," published by Caterpillar Tractor Company.

The jobs of laying pipes from the oil fields of Pennsylvania, Illinois, Texas, and California present problems peculiar to their territory, and the gigantic task of surmounting these obstacles by track-type equipment is pictured in the publication. All the phases of clearing, moving supplies and equipment, carrying, stabbing, lifting and lowering pipe, and back-filling are presented.

(35) Position-adjusting control

Some of the many ways that modern automatic controls are helping industrial users to improve operating efficiency are outlined in a newly revised, 40-page catalog, "L&N Electric Control, Position-Adjusting Type," issued by the Leeds and Northrup Company. Applicable to practically any process which can be controlled by moving a valve, vane or damper, this electrically-actuated equipment is regulating temperature, pH, electrolytic conductivity and gas analysis in steel mills, chemical plants, paper mills, and hundreds of other industries.

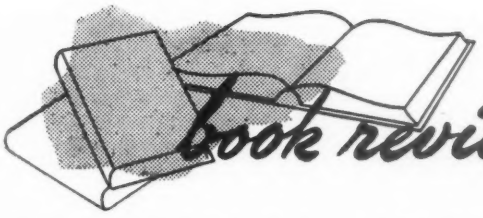
Illustrated with pictures of actual installations, this catalog shows how the PAT system provides complete control adaptable to nearly any control problem. The system provides full proportional control action with automatic droop-correction, obtained through the use of the accurate, reliable balance method both for measurement and control. In addition to the well-known Micromax instruments, the publication also lists the Speedomax line of controllers.

(36) Wrought iron sling chains

Publication of a new bulletin descriptive of Sterling wrought iron sling chains is announced by The Cleveland Chain and Manufacturing Company. Content includes sling chain safety rules and full data on chain inspection, use and care. Recommended load limits are listed in detail for various chain sizes and suspension angles. Single and double sling chain specifications are presented in tabular form.

(37) Flexible check valve

A new Bulletin No. 610-B is now available describing the operation and performance of Grove Chex-Flo check valves of the expansible tube type, which are employed on air, gas, oil or water at temperatures not exceeding 150 F.



● **Air Conditioning,** *by Herbert and Harold Herkimer. Chemical Publishing Company, 26 Court Street, Brooklyn, New York. Pages, 692. Price, $12.*

Thirty-seven years accumulation of notes and empirical formulas combined with transactions of the two leading technical societies of the air conditioning industry, and selections from representative manufacturers' technical literature provides an indispensable book for men engaged in this growing industry.

All required information on every phase of air conditioning is included; estimation, sales, promotion, installation, supervision, service, etc. It reviews the laws of chemistry and physics associated with air conditioning, and then goes on to the practical aspects, such as equipment, materials and costs.

● **Principles of Micropaleontology,** *by Martin F. Glaessner, Australian Petroleum Company and Melbourne University. John Wiley and Sons, 440 Fourth Avenue, New York 16. Pages, 296. Price, $6.*

Dr. Glaessner's comprehensive textbook on micropaleontology should be of particular interest to petroleum geologists and paleontologists, as well as to teachers of those subjects. Virtually all the major groups of microfossils are covered, with primary emphasis on paleontology of the Foraminifera.

The book begins with the origins and present status of micropaleontology, and progresses to the classification of microfossils. The section on stratigraphic micropaleontology is especially important to men of the oil industry, because of the full discussion of petroleum exploration and oil field practice in Europe, Asia, Russia, and the Pacific Region. Methods used in detailed analysis, to examples of the application of microfaunal studies to economic geology, indicates the volume's scope. Also included is a synopsis of the author's revised classification of Foraminifera, with the stratigraphic range of genera indicated. Numerous photographs, charts, and drawings add to the effectiveness of this extensive work.

● **High-Speed Mathematics,** *by Lester Meyers. D. Van Nostrand Company, 250 Fourth Avenue, New York 3. Pages, 543. Price, $5.95.*

All the available rapid methods and short-cuts for numerical calculations have been woven together to form a most interesting and useful program of mathematical training. Described are direct applications to practical problems, solved in step-by-step detail. Examples are given to fit a wide range of calculations in all branches of business and industry. Using only the basic methods of arithmetic, it shows how to gain the utmost speed, dexterity and confidence in the shortest possible time.

● **The Fracture of Metals,** *by the American Welding Society, 33 West 39th Street, New York 18. Pages, 58. Price, $1.*

This report provides a means for engineers and designers to approach intelligently the problem of fracture. Part I includes the original survey of the literature and an analysis of the theories of fracture and applications of principles, and Part 2 clarifies new developments in the theories of fracture and plastic flow. In addition to the extensive bibliography of approximately 300 references, a recommended research program is outlined.

● **Best's Safety Directory for 1948,** *by Alfred M. Best Company, 75 Fulton Street, New York 7. Pages, 494. Price, $5.*

The new Safety Directory covers the entire field of safety, fire protection and control, hygiene, first-aid and sanitation. It combines the features of a safety manual, directory, index, encyclopedia and catalog into one volume. One outstanding feature of this book is its indexing and subject-grouping system. These devices, plus countless illustrations, make it easy to locate safety products even when the user is not certain of the type or name of product he needs. Arrangement of subjects also serves as a checklist of hazards. Aside from safety directors and safety engineers, men working in any part of the industry that has its occupational hazards will profit from this directory.

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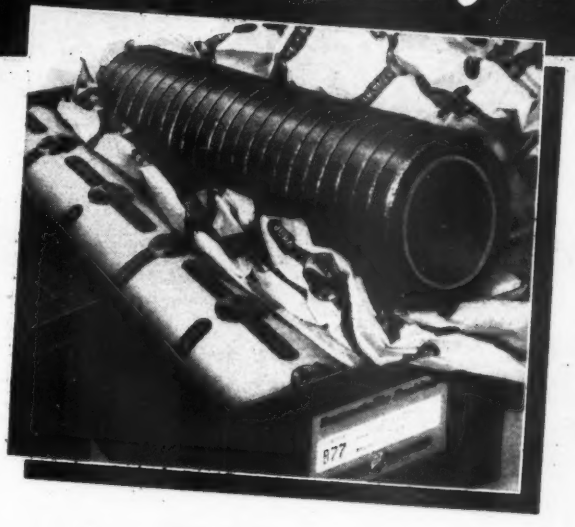

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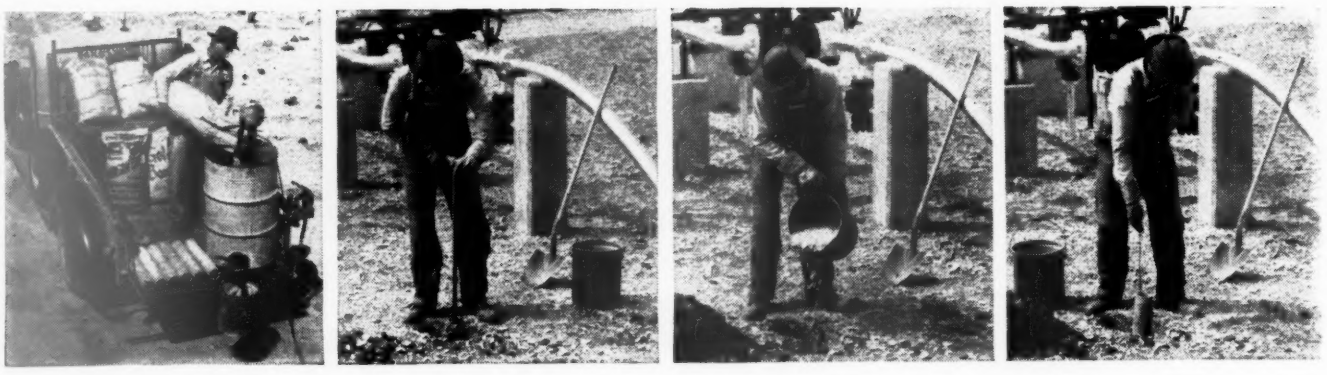

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INSTALLMENT No. 136

A valuable and regular feature of *The Petroleum Engineer*, the Continuous Tables, now in their twelfth year of publication, were designed to save time and effort for the technician and the practical field or plant worker. The tables have proved one of the most popular and helpful departments of *The Petroleum Engineer*. Data are presented in the simplest form available with many types of information included that are best presented by curves or nomographs when three or more variables must be considered simultaneously.

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This index will be revised monthly. The index for installments 1-12, inclusive, will be found in the May, 1938, issue; 13-24, inclusive, in the June, 1939, issue; 25-36, inclusive, in the June, 1940, issue; 37-48, inclusive, in the June, 1941, issue; 48-60, inclusive, in the June, 1942, issue; 61-72, inclusive, in the June, 1943, issue; 73-79, inclusive, in the January, 1944, issue; 80-82, inclusive, in the April, 1944 issue; 83-85, inclusive, in the July, 1944, issue; 86-88, inclusive, in the October, 1944, issue; 89-91, inclusive, in the January, 1945, issue; 92-94, inclusive, in the April, 1945, issue; 95-97, inclusive, in the July, 1945, issue; 98-100, inclusive, in the October, 1945, issue; 101-103, inclusive, in the January, 1946, issue; 104-106, inclusive, in the April, 1946, issue; 107-109, inclusive, in the July, 1946, issue; 110-112, inclusive, in the October, 1946, issue; 113-115, inclusive, in the January, 1947, issue; 116-118, inclusive, in the April, 1947, issue; 119-121, inclusive, in the July, 1947, issue; 122-124, inclusive, in the October, 1947, issue; 125-127, inclusive, in the January, 1948, issue; 128-130, inclusive, in the April, 1948, issue; 131-133, inclusive, in the July, 1948, issue.

INDEX TO TABLES

	Index No.	Page	Issue
Strength and care of fiber rope	P 094.6	99	Oct.
Clearance ratio chart—casing protectors	(sheet 1) P 425.215.1	195	Aug.
Clearance ratio chart—casing protectors	(sheet 2) P 425.215.1	197	Aug.
Clearance ratio chart—drill pipe stabilizers	(sheet 3) P 425.215.1	229	Sept.
Clearance ratio chart—drill pipe stabilizers	(sheet 4) P 425.215.1	231	Sept.
Factors in the selection and use of sucker rod pumps	(sheet 3) P 514.1	199	Aug.
Factors in the selection and use of sucker rod pumps	(sheet 4) P 514.1	207	Aug.
Factors in the selection and use of sucker rod pumps	(sheet 5) P 514.1	223	Sept.
Factors in the selection and use of sucker rod pumps	(sheet 6) P 514.1	225	Sept.
Calculation of well loads and selection of pumping units	(sheet 1) P 514.10	95	Oct.
Calculation of well loads and selection of pumping units	(sheet 2) P 514.10	97	Oct.
Properties of high yield strength seamless pipe	(sheet 3) P 615.23	201	Aug.
Properties of high yield strength seamless pipe	(sheet 4) P 615.23	203	Aug.
Formulas for the preparation of tank gauge tables	(sheet 1) P 671.	233	Sept.
Formulas for the preparation of tank gauge tables	(sheet 2) P 671.	235	Sept.
Formulas for the preparation of tank gauge tables	(sheet 3) P 671.	91	Oct.
Formulas for the preparation of tank gauge tables	(sheet 4) P 671.	93	Oct.
Control of narrow boiling range fractionating columns	P 741.4	205	Aug.
Chemical cleaning methods for refinery equipment	(sheet 1) P 749.1	227	Sept.
Chemical cleaning methods for refinery equipment	(sheet 2) P 749.1	101	Oct.
Chemical cleaning methods for refinery equipment	(sheet 3) P 749.1	103	Oct.

INDEX TO ADVERTISERS IN TABLES

	Page	Issue	Backing Table No.
Bucyrus-Erie Company	(sheet 1) 96	Oct.	P 514.10
Foxboro Company, The	(sheet 3) 104	Oct.	P 749.1
Griscom-Russell Co.	(sheet 2) 102	Oct.	P 749.1
Hammond Iron Works	(sheet 4) 94	Oct.	P 671
Marley Company	(sheet 3) 92	Oct.	P 671
Toledo Pipe Threading Machine Co.	(sheet 2) 98	Oct.	P 514.10
Torrington Co.	100	Oct.	P 094.6

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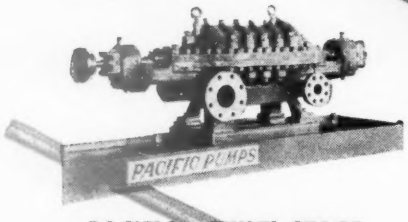

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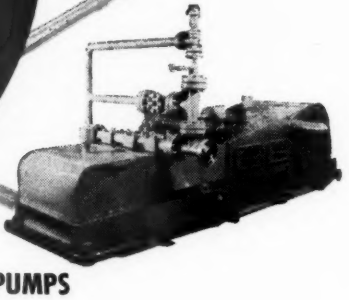

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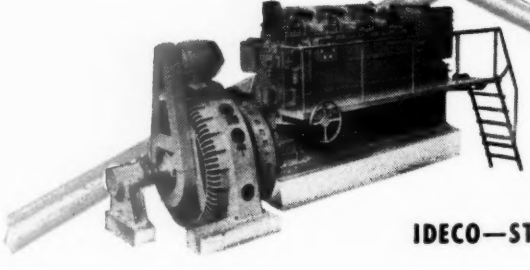

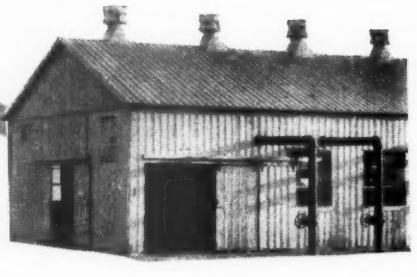

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FORMULAS FOR THE PREPARATION OF TANK GAUGE TABLES

Elliptical zone formula — horizontal cylindrical tanks:

$$V_1 = \frac{\pi BGF}{6A}(3A^2 - 3CD - G^2) \quad \ldots\ldots\ldots\ldots (10)$$

In which:

V_1 = the volume of the segment between limits C and D,
C = the distance from the center of the spheroid to the closer intersecting horizontal plane,
D = the distance from the center of the spheroid to the more distant intersecting horizontal plane,
A = one-half the major axis,
B = one-half the minor axis,
G = the distance between the limits C and D,
F = volume factor (as 7.4805, the number of U. S. gal per cu ft).

Thus, the volume of any small section M from the center of the spheroid becomes:

$$V_M = \frac{\pi BFG}{2A}(A^2 - CD) - \frac{\pi BG^3F}{6A} - \frac{\pi BFG}{2A}\left[A^2 - (M-1)G \times (MG)\right] - \frac{\pi BG^3F}{6A}$$

Where (M—1)G is substituted for C and (MG) is substituted for D, M being taken as the number of G sections from the center of the spheroid.

$$V_M = \frac{\pi BFG}{2A}\left[A^2 - (M^2 - M)G^2\right] - \frac{\pi BG^3F}{6A}$$

Let:

$$K_4 = \frac{\pi BGFA}{2} - \frac{\pi BG^3F}{6A} \quad (11)$$

$$K_5 = \frac{\pi BG^3F}{A} \quad \ldots\ldots (12)$$

Then:

$$V_M = K_4 - \frac{M^2 - M}{2}K_5 \quad \ldots (13)$$

The volume of the $(M+1)^{th}$ section will be:

$$V_{M+1} = K_4 - \frac{(M+1)^2 - (M+1)}{2}K_5$$

$$= K_4 - \frac{M^2 + M}{2}K_5$$

$$V_M - V_{M+1} = K_4 - \frac{M^2 - M}{2}K_5 - K_4$$

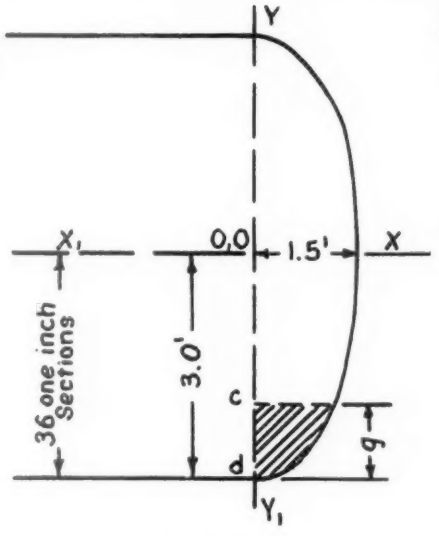


FIG. 3.

$$+ \frac{M^2 + M}{2}K_5 = MK_5$$

Therefore:

$$V_M = V_{M+1} + MK_5 \quad \ldots\ldots (14)$$

The application of formulas (13) and (14) is similar to (4) and (5) as given in the spherical zone formulas.

For example, in Fig. 3, if:

A=3.0 ft
B=1.5 ft
G=1 in.=0.083333 ft
F=7.4805 gal per cu ft.

Find the individual and cumulative volumes of the 36 1-in. sections.

Solution:

From formula (11): $K_4 = 4.4053$.

From formula (12): $K_5 = 0.0068$.

Substituting in formula (13), the volume of the 36th section from the center of the spheroid is:

$$V_{36} = 4.4053 - \frac{36^2 - 36}{2}K_5$$

$$= 0.121 \text{ gal.}$$

Then substituting in formula (14), the volume of the 35th section is:

$$V_{35} = V_{36} + 35\,K_5$$

$$= 0.121 + 35 \times 0.0068.$$

In the application of formula (14) to the calculating machine, the value V_{36} is placed in the lower dial and K_5 is placed on the keyboard. Then multiply by each decreasing value of M, as 35, 34, 33, etc., for the volume of that particular section M. The complete set of calculations for the 36 1-in. sections is as follows:

Section number	Volume of section, gal	Cumulative volumes, gal
36	0.121	0.121
35	0.359	0.480
34	0.590	1.070
33	0.815	1.885
32	1.032	2.917
31	1.243	4.160
30	1.447	5.607
29	1.644	7.251
28	1.835	9.086
27	2.018	11.104
26	2.195	13.299
25	2.365	15.664
24	2.528	18.192
23	2.685	20.877
22	2.834	23.711
21	2.977	26.688
20	3.113	29.801
19	3.242	33.043
18	3.365	36.408
17	3.480	39.888
16	3.589	43.477
15	3.691	47.168
14	3.786	50.954
13	3.875	54.829
12	3.956	58.785
11	4.031	62.816
10	4.099	66.915
9	4.160	71.075
8	4.215	75.290
7	4.262	79.552
6	4.303	83.855
5	4.337	88.192
4	4.364	92.556
3	4.385	96.941
2	4.398	101.339
1	4.405	105.744

Using formula (10) to check the total volume:

$$\text{Volume} = \frac{\pi BGF}{6A}(3A^2 - 3CD - G^2)$$

Where:
C=0
D=3.0 ft
G=3.0 ft.
Volume=105.753 gal.

Elliptical zone formula for vertical tanks:

$$V_1 = \frac{\pi A^2GF}{3B^2}(3B^2 - 3CD - G^2) \quad \ldots\ldots\ldots\ldots (15)$$

In which:

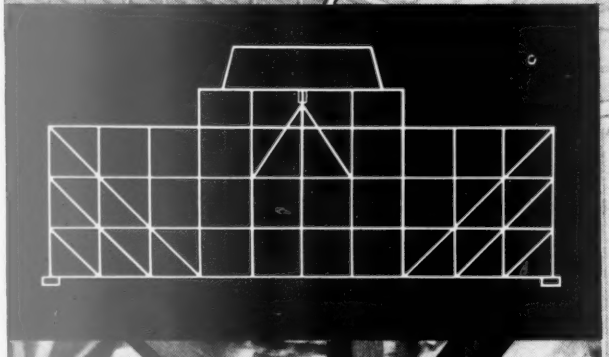
V_1 = the volume of the segment,
C = the distance from the center of the spheroid to the closer bounding plane,
D = the distance from the center of the spheroid to the more distant bounding plane,
A = one-half of the major axis,
B = one-half of the minor axis,
G = D — C
F = volume factor (as 7.4805, the number of U. S. gal. per cu ft).

Taken from the exclusive article, "Volume Determination of Tanks," by T. F. Phillians, published in *The Petroleum Engineer*, March, 1948, pages 174 to 178, inclusive.

HURRICANE
TORNADO
EARTHQUAKE

Whatever the Elements Present

Double-Flow
COOLING TOWERS
Are Built To Take It!



Your cooling tower may never have to withstand these elemental furies, but when you install a Marley Double-Flow you have complete assurance that your tower can and will take it. The proof of this is the fact that Double-Flows have been subjected to Atlantic and Gulf hurricanes, mid-western tornadoes, Pacific earthquakes. When the force of wind was spent and seismic shock stilled, Double-Flow towers stood undamaged beside the debris of less sturdily built units.

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Ask your nearest Marley engineering service representative to give you the facts and figures that will let you determine the extent to which Double-Flow towers are designed for safety.

MARLEY COOLING TOWERS

THE MARLEY COMPANY, INC. • KANSAS CITY 15, KANSAS

FORMULAS FOR THE PREPARATION OF TANK GAUGE TABLES

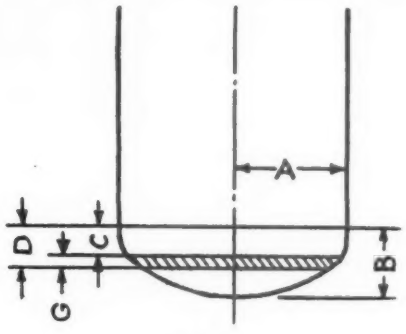

FIG. 4.

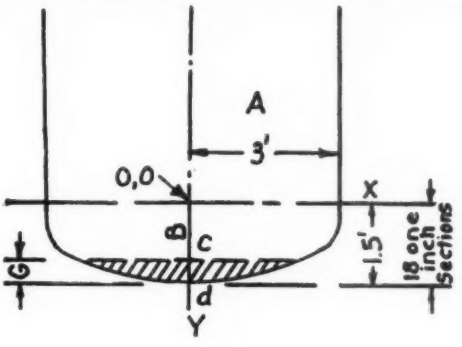

FIG. 5.

Then, if the semispheroid be divided into a uumber of segments of equal height G, the volume of the M^{th} segment from the center of the spheroid is:

$$V_M = \frac{\pi A^2 GF}{B^2}\left[B^2 - \frac{G^2}{3} - (M-1)\,G\,(MG)\right]$$

Where:

$(M-1)\,G = C$

And:

$MG = D$

Therefore:

$$V_M = \frac{\pi A^2 GF}{B^2}\left[B^2 - \frac{G^2}{3} - (M^2-M)G^2\right]$$

$$V_M = \left(\pi A^2 GF - \frac{\pi A^2 G^3 F}{3B^2}\right) - \left(\frac{2\pi A^2 G^3 F}{B^2}\right)\left(\frac{M^2-M}{2}\right)$$

Let:

$$K_6 = \pi A^2 GF - \frac{\pi A^2 G^3 F}{3B^2} \quad . \quad . \quad (16)$$

$$K_7 = \frac{2\pi A^2 G^3 F}{B^2} \quad . \quad . \quad . \quad . \quad (17)$$

Then:

$$V_M = K_6 - \left(\frac{M^2-M}{2}\right)K_7 \quad . \quad . \quad (18)$$

The volume of the $(M+1)^{th}$ segment will be:

$$V_{M+1} = K_6 - \frac{(M+1)^2-(M+1)}{2}K_7$$

$$= K_6 - \left(\frac{M^2+M}{2}\right)K_7$$

Then:

$$V_M - V_{M+1} = K_6 - \left(\frac{M^2-M}{2}\right)K_7 - K_6 + \left(\frac{M^2+M}{2}\right)K_7 = MK_7$$

Whence:

$$V_M = V_{M+1} + MK_7 \quad . \quad . \quad . \quad . \quad . \quad (19)$$

That is, the volume of any segment of the spheroid is equal to the sum of the volume of the succeeding segment and the product of the number of the segment and the constant K_7.

In applying the formula to a tank, the volume of the final segment is found by using formula (18); then the volume of each preceding segment is found by the use of formula (19). In using a calculating machine, the volume of the final segment is placed in the lower dial and K_7 is placed on the keyboard. Then each decreasing value of M is used as a multiplier of K_7 and is added to the volume found previously; that is, the lower dial is not cleared during the process.

Following is an example showing the application of formulae (15), (18), and (19):

In Fig. 5 if:

$A = 3.0$ ft

$B = 1.5$ ft $= 18$ in.

$G = 1$ in. $= 0.083333$ ft

$F = 7.4805$ gal per cu ft.

Find the individual and cumulative volumes of the 18 1-in sections.

Solution:

From formula (16) $K_6 = 17.6074$.

From formula (17) $K_7 = 0.1088$.

Substituting in formula (18) the volume of the 18th section from the center of the spheroid is:

$$V_{18} = 17.6074 - \frac{18^2-18}{2} \times 0.1088$$

$$= 0.9610 \text{ gal.}$$

Then substituting in formula (19) the volume of the 17th section is:

$$V_{17} = V_{18} + 17K_7$$

$$= 0.9612 + 17 \times 0.1088$$

$$= 2.8106 \text{ gal.}$$

In the application of formula (19) to the calculating machine, the value V_{18} is placed in the lower dial and K_7 is placed on the keyboard. Then multiply by each decreasing value of M, as 17, 16, 15, etc., for the volume of that particular section M. During the series of calculations, the lower dial and the keyboard are not cleared at any time.

The complete set of calculations for the 18 1-in. sections is as follows:

Section number	Volume of section, gal	Cumulative volumes, gal
18	0.9610	0.9610
17	2.8106	3.7716
16	4.5514	8.3230
15	6.1834	14.5064
14	7.7066	22.2130
13	9.1210	31.3340
12	10.4266	41.7606
11	11.6234	53.3840
10	12.7114	66.0954
9	13.6906	79.7860
8	14.5610	94.3470
7	15.3226	109.6696
6	15.9754	125.6450
5	16.5194	142.1644
4	16.9546	159.1190
3	17.2810	176.4000
2	17.4986	193.8986
1	17.6074	211.5060

Using formula (15) to check the total volume:

$$\text{Volume} = \frac{\pi A^2 GF}{3B^2}(3B^2 - 3CD - G^2)$$

Where:

$C = 0$

$D = 1.5$ ft $= B$

$G = 1.5$ ft $= B$

$$\text{Volume} = \frac{2}{3}\pi A^2 BF = 211.5066 \text{ gal.}$$

Taken from the exclusive article, "Volume Determination of Tanks," by T. F. Phillians, published in *The Petroleum Engineer*, March, 1948, pages 174 to 178, inclusive.

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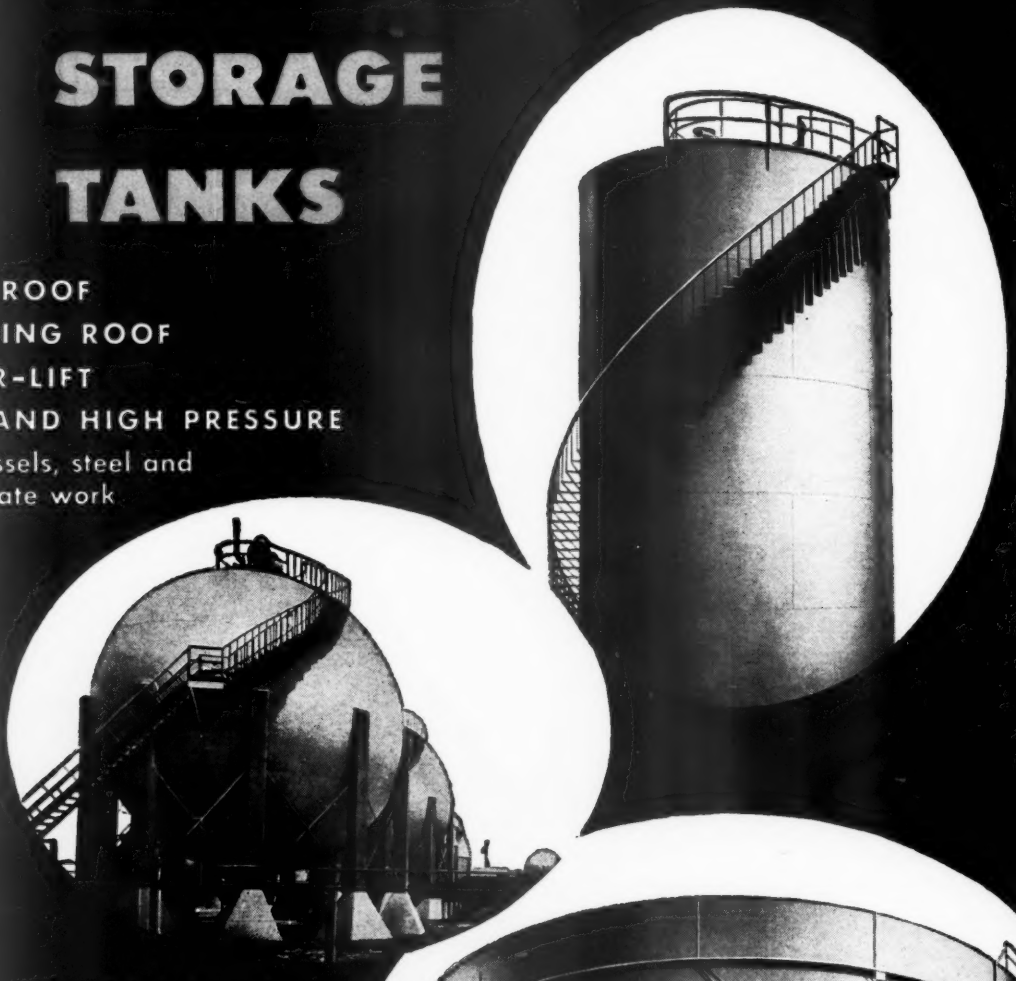

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CALCULATION OF WELL LOADS AND SELECTION OF PUMPING UNITS

For most well load calculations, the Slonneger formula, as approved by the API, is probably the simplest method for calculation of loads at average pumping speeds. Average pumping speeds refer to those below 20 spm. If pumping speeds above 20 spm are anticipated, the Mills formula is found to indicate a load nearer that found by checking actual operations with a dynamometer. The Mills formula is suggested for speeds between 20 and 25 spm, and the author thinks that a third formula is desirable for speeds above 25 spm. This, in effect, would suggest that either the Slonneger or the Mills formula is satisfactory on speeds below 20 spm.

The Mills formula with its higher impulse factor is suggested in the intermediate speed range of 20 to 25 spm. For wells pumping from 25 to 35 spm, which is an unusual operation and an extreme pumping speed, it is questionable whether either formula allows sufficient impulse factor, as speed increases the loading of pumping units and engines much faster than either formula indicates. For these fast pumping installations, it is suggested that the Mills impulse factor be applied to the weight of the rod string and to the weight of the column of fluid. Mills applies his impulse factor only to the weight of the rods. Thus:

(Mills formula) $$P = WO + WR\left(1 + \frac{SPM^2 \times \text{Stroke in inches}}{70{,}400}\right)$$

for 10 to 25 spm

Or:

(Suggested Caraway formula)

$$P = (WO + WR)\left(1 + \frac{SPM^2 \times \text{Stroke in inches}}{70{,}400}\right)$$

for 25 to 35 spm

Where:

P = peak polished rod load, lb.
WO = weight of fluid lb = (plunger²) (0.34) (depth)
WR = weight rod string, lb.

Our experience suggests that some impulse be allowed to start the column of fluid upward; however, it may be that the impulse factor suggested by Mills for application only to the rod string is sufficiently high to make some allowance for the fluid column at intermediate speeds below 25 spm.

Slonneger arrives at an impulse factor by using one plus spm, times length of stroke in inches, divided by 5400. This factor is applied to the total of the weight of the rods and of the column of fluid.

Thus:

$$P = (WO + WR)\left(1 + \frac{SPM \times Stroke}{5400}\right)$$

Dynagraph cards confirm the suggestion regarding pumping speeds above 20 spm even though it may be questioned that loads are as high as would be indicated by the formula suggested for speeds greater than 25 spm. Experience in fields with high fluid levels and with considerable bottom hole pressure assistance would probably confirm the need for applying the impulse factor as suggested. The experience of those that have handled production in the older fields and lifted well fluid from bottom with no help would probably agree with the thought expressed in this article. Experience has shown that high speed, large fluid volumes, and long lift, subjects the pumping equipment to unusual loading. Comparative figures are shown, using the three suggested methods for calculating well loads. The East Texas field is used as a typical example for these calculations, it being the largest and probably the best known oil field in the States. Many have had experience in this area and will be interested in these figures.

	20 spm calculated			25 spm calculated			30 spm calculated		
	Impulse factor	Peak beam load, lb	Peak torque, in.-lb	Impulse factor	Peak beam load, lb	Peak torque, in.-lb	Impulse factor	Peak beam load, lb	Peak torque, in.-lb
Slonneger	1.2	8,650	93,500	1.25	9,000	97,000	1.30	9,360	101,000
Mills	1.3	8,440	91,000	1.48	9,200	99,500	1.69	10,040	108,500
Caraway	1.3			1.48	10,650	109,000	1.69	12,175	132,000

Although wells in the East Texas field are about 3700 ft deep, a strong water drive from the west maintains a pumping fluid level above 2000 ft on most west side wells. Even though west side wells have a high fluid level, the fluid level on the east side of the field is not maintained as high by the water drive from the west and as a result the fluid in many wells is lifted from the bottom of the hole. It is necessary on some west side wells to lift 400 to 600 bbl of fluid to produce 20 bbl or less of oil. Wells on the east side of the field produce little or no water, and it is necessary to lift only the 20 bbl of "allowable" oil. This can be done with 8 to 12-hp pumping units using a short stroke and slow pumping speeds. West side wells are equipped with units in the 20 to 30 hp range with 48-in. to 54-in. stroke assemblies, and operate at 20 to 25 spm depending on percentage of water. Fluid levels vary from 1200 ft to more than 2500 ft, depending on differences in formation, although most of the west side wells cannot be pumped down below 2000 ft. The calculations in this comparison are based on the use of 2500 ft of ¾-in. rods with a 2¼-in. working barrel in 2½-in. tubing and 54-in. stroke pumping unit. A 2000-ft fluid level is assumed. From these figures, and from actual dynagraph loads, it is evident that pumping equipment in the 20-hp capacity should be sufficient for lifting 400 bbl.

Some operators prefer to use 3000 ft to 3700 ft of rods and lift oil from the bottom rather than from higher in the hole, which would have a skimming effect. Bottom hole chokes have helped to reduce the water-oil ratio in East Texas wells when installed as soon as the wells began to make water. Operators believe from their records that the use of the bottom hole choke, which allows a small amount of fluid to settle out in the annular space between tubing and casing, has, in many instances, prolonged the productive life of wells as much as two years. Producing the small amount of oil and water that will flow into the annular space reduces the danger of coning and channeling large volumes of water into the well during its early pumping life.

Dynagraph cards have been taken at speeds of 25 to 35 spm that gave measured loads 30 to 60 per cent above the calculated loads for such operating conditions. Lacking a complete range of cards from 15 to 30 spm on any of those wells, it has been necessary to use the cards shown herein to give a full speed range comparison. Shown are the card and peak polished-rod load at 16 spm, at 20 spm, at 25 spm, and at 29 spm; however, cards and curves of other speeds on this well are available. These fit in about as interpolations would indicate. Compared to actual load at 29 spm measured with a dynagraph, it is found that the Slonneger calculated load is 17.5 per cent low. Compared to the measured load, the Mills calculated load is 9.5 per cent low, and the load calculated by the suggested impulse application is 7.4 per cent high. The bottom hole pump in the well on which these dynagraph cards were taken had been in operation almost seven months, and it is believed that operation in 98 per cent water for that period of time would wear the working barrel considerably. This wear would tend to produce smaller cards and would keep measured loads nearer the low figures of the calculated loads. A new working barrel might have shown higher loads, i.e., closer to the calculated loading, using the suggested (Caraway) formula.

Taken from the exclusive article, "How to Calculate Well Loads and Select Pumps," by A. Ed Caraway, Dallas Division Manager, Lufkin Foundry and Machine Company, published in *The Petroleum Engineer*, June, 1948, pages 108 to 113, inclusive.

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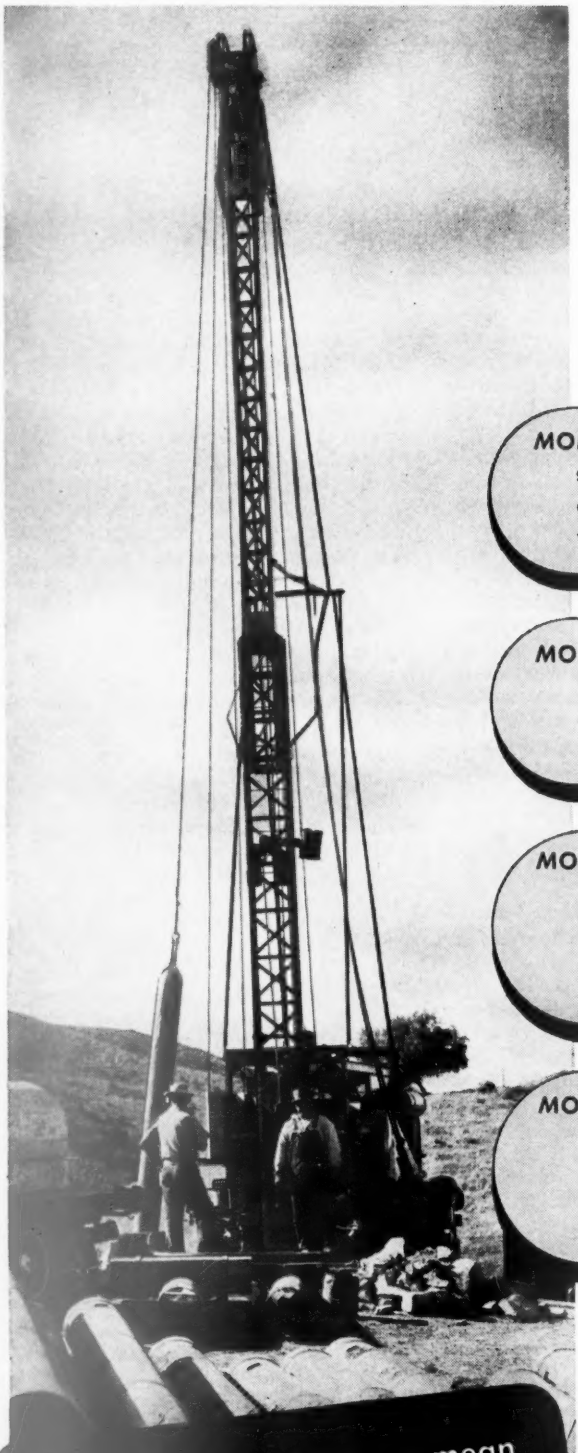

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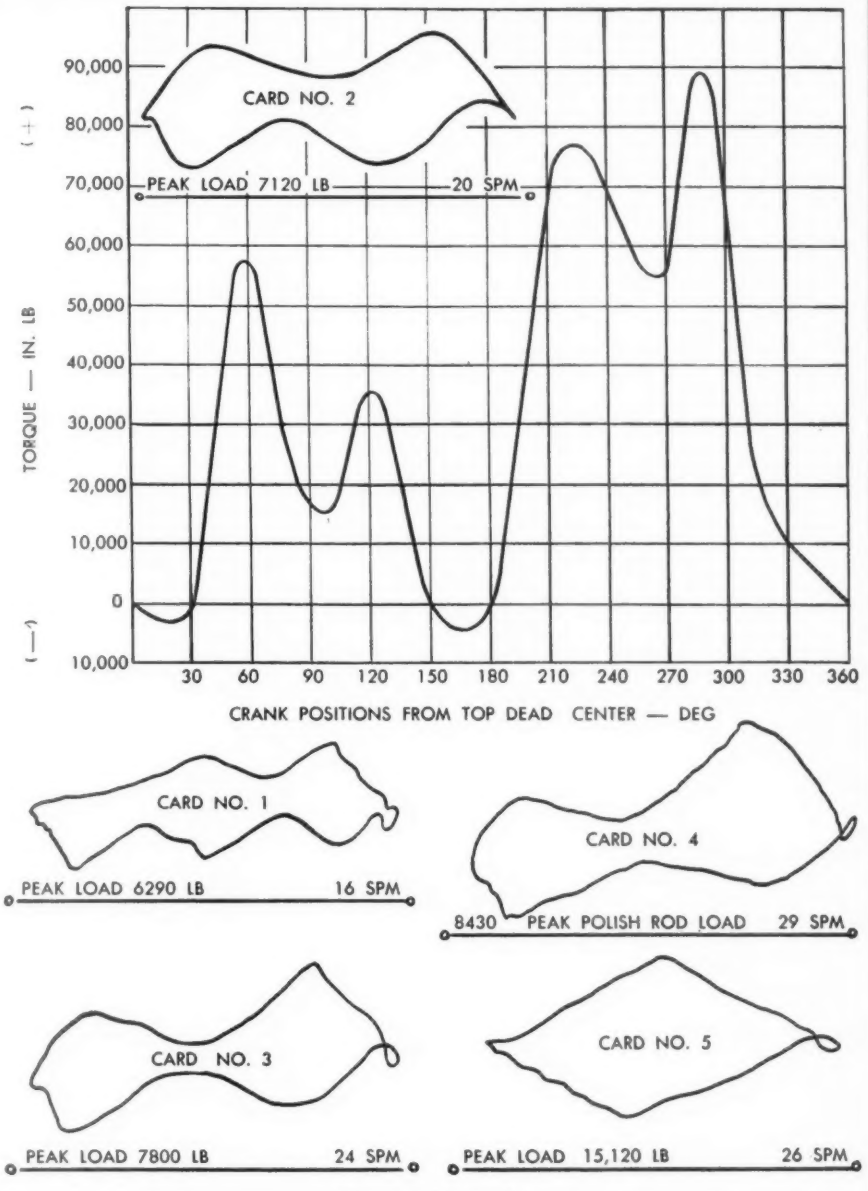
CALCULATION OF WELL LOADS AND SELECTION OF PUMPING UNITS

These comparisons and the results of other dynagraph tests on high speeds confirm the belief that the third formula would be preferable for calculating loads for fast pumping operations. On these cards, which were used because of speeds from 16 to 29 spm on the same well, we get closer to the measured load by use of the larger impulse factor, which combines the weight of the fluid and rods. With the working barrel in better condition, it appears that the measured load and the calculated load by the suggested Caraway formula would have been very close. Dynagraph card No. 5 was taken on a well equipped with a 54-in. stroke unit pumping 26 spm. Twenty-six hundred ft of ¾-in. rods were run to the bottom of the well with a 2¼-in. working barrel in 2½-in. tubing.

Slonneger's formula allows a peak torque loading of 120,000 in.-lb for these condition. Mills' formula results in 121,000 in.-lb and a calculated torque of 148,000 in.-lb. Actually, the dynagraph card indicated more than 180,000 in.-lb torque. This card was taken on the Berg, Laney, and Brown lease, Cook well No. 3 in the Smackover field. This is an unusual load and would not be anticipated on all fast pumping wells. This unit was lifting dead oil and pounding fluid at the bottom of the hole. The unit and engine were severely overloaded although what was thought to be a safe allowance was made for those conditions of speed and high fluid volumes.

Dynagraph cards on any two wells may be different and exceptions will be found to any method; however, results on a large percentage of tests at these fast pumping speeds will bear out the calculations and comparisons shown above. Loads on wells in the Smackover, Arkansas, Mexia, Texas, and other old fields also confirm the suggestion that the Mills impulse factor should be applied to the total of rod weight and fluid weight in calculating loads for the selection of pumping equipment where operators are pumping from 25 to 35 spm. Fluid levels are near the bottom of the hole and many wells pound fluid continuously. This adds considerable shock load to both the sucker rods and pumping unit, and it contributes to the fatigue that is set up in the equipment, causing premature failures. Experience shows the wisdom of assuming severe load conditions in recommending lifting equipment, and operators usually agree to the installation of equipment having sufficient capacity to care for such conditions. In some applications, we will agree that the full capacity of the equipment is never required. Fluid levels may remain high, and the bottom hole pressure may remain strong; however, late in the life of most production, these "lifting helps" are gone, and the equipment is lifting a "dead" load from the bottom of the well.



Dynagraph cards.

spm	Peak polished-rod dynagraph measured load, lb	Slonneger calculated load, lb 1500 ft fluid, 2000 ft rods	Mills calculated load, lb 1500 ft fluid, 2000 ft rods	(Suggested) Caraway calculated load, lb 1500 ft fluid, 2000 ft rods
16	6290	6450	6220	
18	6630	6550	6380	
20	7120	6670	6560	7250
24	7800	6900	7040	8000
29	8430	7180	7700	9100
Avg. percentage difference in calculated load and measured load		—17.5 per cent	—9.5 per cent	—7.4 per cent

It should be emphasized that it is not a safe practice to buy pumping equipment smaller than calculations indicate. Although it is true that equipment is designed with a large safety factor, it is also true that manufacturers find this safety factor necessary to give the long, economical service that operators expects.

Taken from the exclusive article, "How to Calculate Well Loads and Select Pumps," by A. Ed Caraway, Dallas Division Manager, Lufkin Foundry and Machine Company, published in *The Petroleum Engineer*, June, 1948, pages 108 to 113, inclusive.

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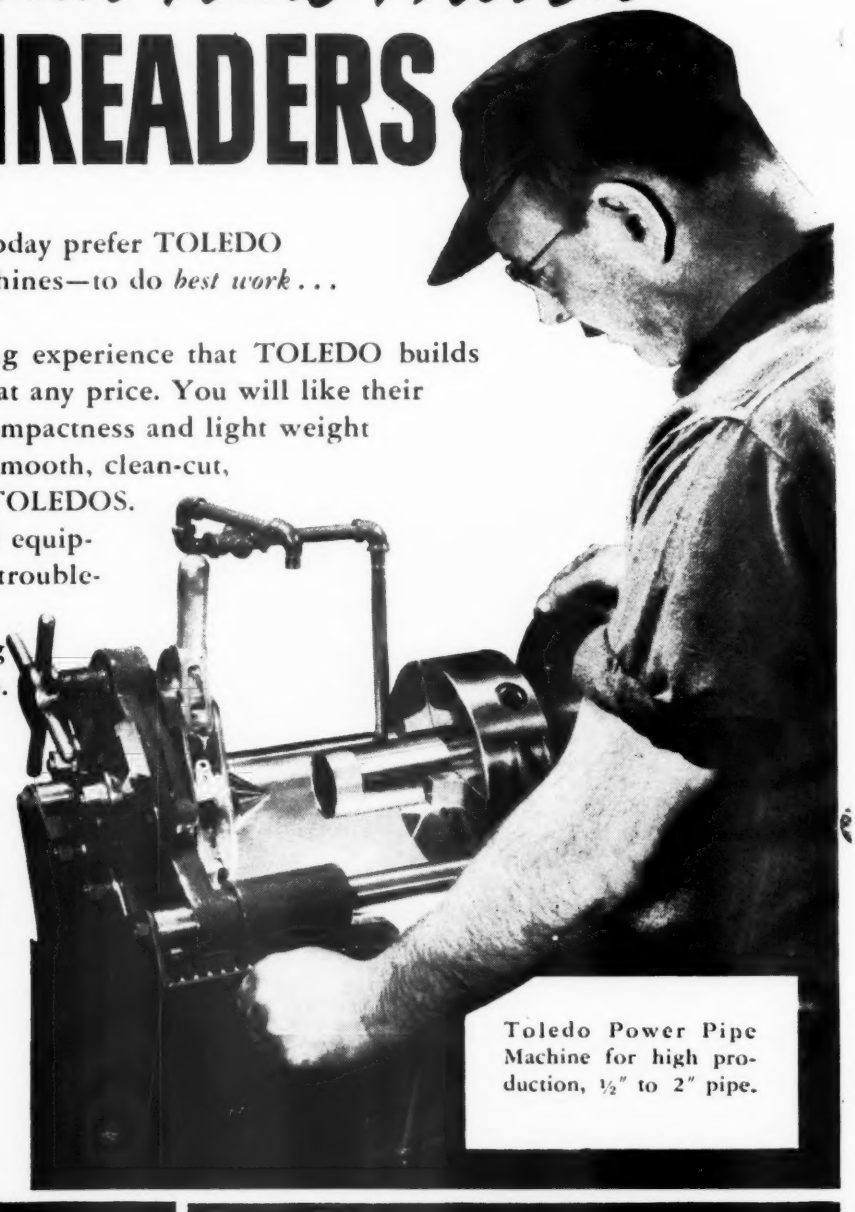

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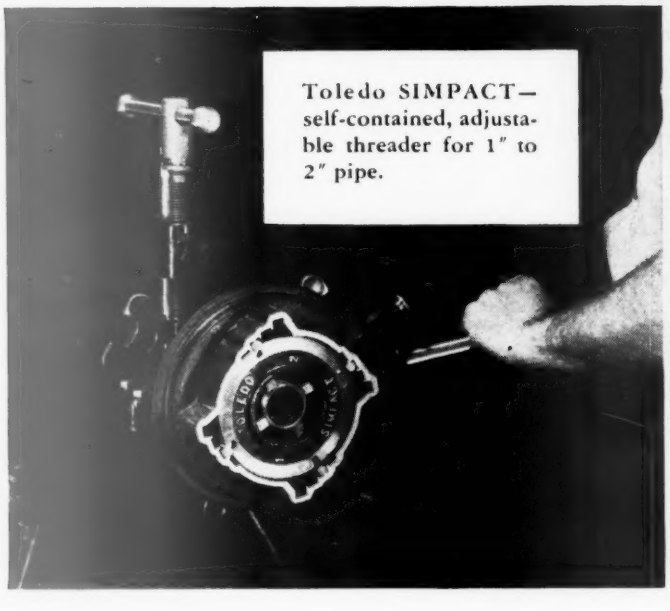

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STRENGTH AND CARE OF FIBER ROPES

● **Kinds of rope.** Safety in the use of any rope begins with the selection of the fiber. There are three types of fiber rope.

1. Manila fiber.
2. Sisal fiber.
3. Bast fiber.

A good grade of manila fiber rope when new and clean is hard but pliant, yellowish in color with a silvery or pearl luster. It has a smooth almost silky feel. Manila fiber comes from a plant of the same family as the banana, and being of a cellulose base it is seriously affected by bacterial growths. In manufacturing, the fiber is treated to resist these conditions. A finished rope with a dark color indicates fibers of an inferior grade. Brown or black fibers are weak and often dangerous.

A good grade of sisal rope when new and clean is of a yellowish white color with sometimes a greenish tint. It does not have the gloss of a manila rope and the fibers are stiff and have a tendency to split. The rope feels rough when drawn through the hand.

A good grade of bast fiber rope when new has a dark grey color and is much softer than manila rope. As this rope is made from the bark of a tree, it is often called black hemp.

Sometimes there is doubt regarding what fiber is in a rope. One way to test is to cut a 12-in. sample from the rope and separate it into strands. The oil may be washed out with alcohol or ether and the strands immersed in a bleaching solution acidified with acetic acid. After immersing for 30 min, the sample is washed in water, then in alcohol, and shaken until dry. Exposing the prepared sample to ammonia fumes will cause the fibers to change color. If the fibers are brown, the rope is manila. If the fibers are cherry red, the fibers are hemp or sisal.

When a coil of rope arrives at your job, the inner end is tied to the lashing and tagged. The rope should always come out of the eyes of the coil, not from the outside. A right lay rope will uncoil in a counterclockwise direction, but a cable or left lay rope will uncoil in a clockwise direction.

In taking out kinks, rather than stretch the rope along the floor and untwine the coil, roll the rope up left-handed and when you reach the end of the rope, pass the end down through the center of the coil and then coil the rope right-handed. This is the quickest way to take out kinks.

● **Cleaning.** Extra dirty ropes should be cleaned. To do this, hang the rope in loops over a beam or bar at head height. The sand and mud can be washed away with a water hose. Do not use a high pressure stream as the grit particles may be driven into the fibers. After the rope has been allowed to dry, it may be shaken or beaten with a pliable switch or broom to release sand or dirt.

TABLE 1. Standard manila rope (3 strand).

Diameter, in. (approximate)	Weight per foot, lb (maximum)	Breaking strength, lb (minimum)	Safe load, lb
1/16 (6 yarns)	0.015	450	90
1/4 (6 yarns)	0.020	600	120
5/16 (9 yarns)	0.029	1,000	200
3/8 (12 yarns)	0.041	1,350	270
7/16 (15 yarns)	0.053	1,750	350
1/2 (21 yarns)	0.075	2,650	530
9/16	0.104	3,450	690
11/16	0.133	4,400	880
3/4	0.167	5,400	1,080
13/16	0.195	6,500	1,300
15/16	0.225	7,700	1,540
1	0.270	9,000	1,800
1 1/16	0.313	10,500	2,100
1 3/16	0.360	12,000	2,400
1 1/4	0.418	13,500	2,700
1 5/16	0.480	15,000	3,000
1 1/2	0.600	18,500	3,700
1 5/8	0.744	22,500	4,500
1 13/16	0.895	26,500	5,300
2	1.08	31,000	6,200
2 1/4	1.46	41,000	8,200
2 5/8	1.91	52,000	10,400
3	2.42	64,000	12,800

● **Moisture.** Rope deteriorates very rapidly when saturated with water. For that reason, ropes used in construction work become weak and unsafe unless they are properly cleaned and dried.

Ropes should not be allowed to freeze after becoming wet, as frozen rope breaks easily.

● **Storage.** The effects of temperature and humidity on rope are such that it becomes very important from a safety angle to be sure that rope is stored properly. The perfect storage temperature is 70 F with 65 per cent relative humidity.

● **Causes of failure—overload.** Ropes of different sizes have definite safe load limits. Rope will lose strength rapidly when it is subjected to repeated overloads and sudden strains. The safe load limits are shown in Table I.

Surface wear of a rope occurs when the sheave holes in blocks are too small to permit ample clearance.

Never use rope over blocks with cracked and broken shells or sheaves. Misalignment of blocks or sheaves should be avoided.

The following procedure is of assistance in determining the safety of a rope:

(a) Look for cuts and broken fibers on the outside.

(b) Untwist the rope in several places to inspect the inner fibers. If the inner yarns are bright and unspotted, the rope is good.

(c) Unwind a piece of yarn about 8 in. long and break with the hands. If it breaks easily with little effort, the rope is unsafe.

(d) Rope used around acid and caustic should be inspected frequently. If black or rusty brown spots appear, the rope is damaged.

(e) A rope that has lost its stretch and in which the fibers are dry and brittle should be viewed with suspicion and replaced by a new rope. This is very important if there is a possibility of injury to workers or damage to property.

(f) Any suspicious soft spots, signs of powdering or burned and decayed sections in rope are enough to justify a replacement. A rope is only as stong as its weakest spot.

● **Preservatives.** During rope manufacture, the fibers are treated with an oil to preserve them and lubricate the internal fibers. This lubricant should never be more than 8 to 12 per cent of the rope weight and no substance should be added for the purpose of loading or weighting the rope. A preservative, however, should be applied from time to time to transmission rope to keep it in proper condition and to obtain the maximum service. Graphite and tallow are often used but too much lubricant should be avoided as an excess will cause slipping.

● **Fastenings.** The safety of an operation where rope is used depends a great deal upon the splice, knot, or hitch used. Only accepted methods of knotting should be used. One reason why rope fails so often at a fastening is because each yarn and strand in the standing part of the rope bears its proper share of the load, but in all fastenings the rope is more or less cramped, distorted, or has a sharp bend. This places an overload on the yarns affected and they part until the cramping is overcome. If the effect is prolonged, the rope is stranded and then parts.

The following table gives the results of a series of tests to determine the efficiency of a manila fiber rope used in some well known knots and hitches.

Condition	*Efficiency, %*
Full strength—dry rope	100
Eye splice over iron thimble	90
Short splice in rope	80
Timber hitch	65
Half hitch	65
Bowline	60
Clove hitch	60
Slip knot	60
Square knot	50
Weaver's knot	50
Overhand knot	45

This article cannot cover all the technical safety details of using fiber rope and is intended only as a guide. Supervisors and workmen interested in more exact specifications on rope should consult rope manufacturers or refer to the "Federal Specifications for Rope, Manila" TR 601 published by the Federal Specifications Board, Washington, D. C.

● **Reference**

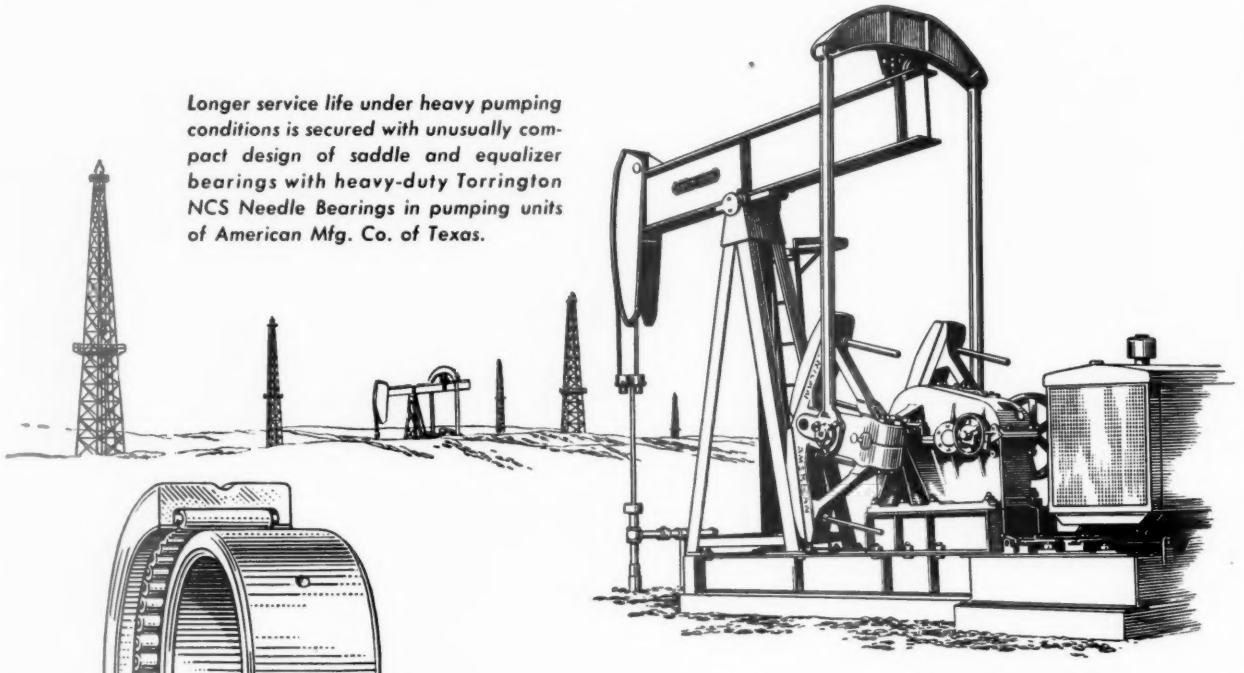
1. Safe Practice Pamphlet No. 6, National Safety Council, Chicago, Illinois.
2. "Inside That Coil of Rope" by Capt. A. R. Hatch, *National Safety News*, February, 1948.

★ ★ ★

Taken from the exclusive article, "Safe Practices in Using Fiber Rope," by Don Attaway, Safety Engineer, Arkansas Fuel Oil Company, published in *The Petroleum Engineer*, July, 1948, pages 47 and 48, inclusive.

How to "Saddle" Pumping Units to Carry Heavy Loads Easily

Longer service life under heavy pumping conditions is secured with unusually compact design of saddle and equalizer bearings with heavy-duty Torrington NCS Needle Bearings in pumping units of American Mfg. Co. of Texas.



. . . in saddle and equalizer applications, Torrington NCS Needle Bearings carry heavier loads in less space a longer time.

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CHEMICAL CLEANING METHODS FOR REFINERY EQUIPMENT

The exact structural grouping of the components is not essential as the primary radicals dictate the chemical reactions involved. (See Table 1.) The carbonates, phosphates, and iron oxides react with hydrochloric acid forming soluble salts. The silicates are rendered soluble through the addition of intensifiers to the acid solution. The sulphates are only partially soluble. In most instances, however, the silicates and sulphates are contained in mixtures with the acid soluble carbonates, phosphates, and oxides. Thus the removal of the acid soluble constituents usually effects the removal of the silicates and sulphates that are present. Scale deposits consisting primarily of silicates or sulphates are removed by alternate applications of alkaline and acid solutions.

The amount of hydrochloric acid required to remove the above-mentioned scale deposits is proportional to the amount of scale present. The average thickness of the scale times the area of the scaled surface give the total amount of scale present in the unit. Table 2 lists the basic amounts of hydrochloric acid required to dissolve the types of inorganic scale deposits most frequently encountered in refinery equipment.

● **Process side deposits.** Similar to water side deposits, process side deposits must be identified but, unlike water side deposits, the identification is of a general nature, influenced greatly by the experience of the chemist. A process side deposit generally is identified by breaking it down into three rough classifications: oil soluble, oil insoluble, and inorganic. The oil soluble component of the sample is determined by extraction with carbontetrachloride, the inorganic component by the unignitable portion of the sample, and the oil insoluble component by difference. From the sample's physical appearance the oil insoluble component is described as being slightly polymerized, highly polymerized or carbonized. The term, "polymerized", is used loosely to designate the magnitude of the material's colecular weight. The inorganic components of the scale generally are composed of the oxides and sulphides of iron, copper and zinc. Typical process side deposits are described in Table 3.

● **Application of the solvents.** The effectiveness of any chemical solvent is determined by four factors. These are: (1) Concentration of the solvent, (2) temperature of the solvent, (3) agitation of the solvent, and (4) contact time of the solvent. In general, increasing any one of these factors will increase the effectiveness of the solvent. The magnitude of each, however, has a limiting factor. The degree of concentration of the solvent must be controlled by costs and corrosion hazards which may be involved. Agitation is controlled by the volume of solvent involved in relation to the size of the pumping equipment and service lines required to give good movement of the fluid by circulation. The temperature to be used is limited almost entirely by corrosion hazards. The time element is limited by extension of down time with its accompanying costs, also by corrosion hazards. Consideration of these four factors indicates that the criterion for successful chemical cleaning should be the use of the lowest concentration of solvent at the lowest temperature for the shortest time necessary to remove the scale deposits.

In the preparation of hydrochloric acid solutions for chemical cleaning it is advantageous to have available portable equipment, which includes solvent storage and pump units as illustrated in Fig. 2. The acid is most economically transported in concentrated solutions, containing the inhibitors and essential addition agents. This concentrated solution then is diluted with water as it is used by means of specially designed proportioning equipment. The acid solution is heated prior to entering the unit by means of a portable jet heater. The alkaline type and hydrocarbon type solvents used in process side equipment require practically the same handling. A small mixing tank may be added for the dissolving of the various solids and liquid agents as needed.

FIG. 2. Mobile mixing and pumping equipment designed for chemical cleaning.

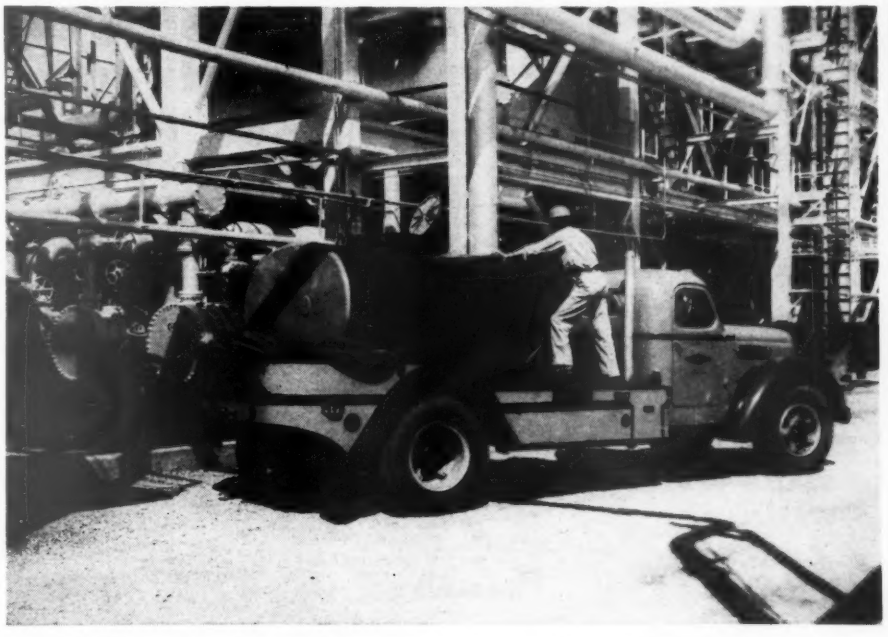

TABLE 1. Chemical reaction of hydrochloric acid on inorganic scale deposits.

$FeO+2\ HCl$	$=FeCl_2+H_2O$
$Fe_2O_3+6\ HCl$	$=FeCl_3+3\ H_2O$
$Fe_3O_4+8\ HCl$	$=2\ FeCl_3+FeCl_2+4\ H_2O$
$FeOOH+3\ HCl$	$=FeCl_3+2\ H_2O$
$Cu_2O+2\ HCl$	$=2\ CuCl+H_2O$
$CuO+2\ HCl$	$=CuCl_2+H_2O$
$FeS+2\ HCl$	$=FeCl_2+H_2S$
$CuS+2\ HCl$	$=CuCl_2+H_2S$
$ZnS+2\ HCl$	$=ZuCl_2+H_2S$
$CaCO_3+2\ HCl$	$=CaCl_2+H_2O+CO_2$
$Ca_{10}(OH)_2(PO_4)_6+20HCl$	$=10\ CaCl_2+2\ H_2O+6H_3PO_4$

TABLE 2. Basic amounts of hydrochloric acid required to dissolve inorganic scale deposits.

Deposit	Formula	Gal of 15 per cent HCl* per cu ft of deposit
Ferrous oxide	FeO	252
Ferric oxide	Fe_2O_3	399
Iron oxide hydrate	FeOOH	230
Ferrous-ferric oxide	Fe_3O_4	343
Cuprous oxide	Cu_2O	133
Cupric oxide	CuO	255
Iron sulphide	FeS	181
Copper sulphide	CuS	152
Zinc sulphide	ZnS	134
Calcium carbonate	$CaCO_3$	93
Calcium hydroxy phosphate	$Ca_{10}(OH)_2(PO_4)_6$	105

*Based on maximum density. The deposits generally have considerable porosity and the amount of acid required is less than that listed.

TABLE 3. Typical process side deposits.

Service	Deposit
Depropanizer	Polymerized organic with considerable iron oxides.
Fractionator	Mostly iron oxides with small amount of organic. Some iron sulphide.
Absorber	Mostly iron oxides intimately mixed with oil.
Light oil exchanger	Highly polymerized organic with small amount of iron oxides.
Catalyst coolers	Intimate mixture of equal amounts of oil and iron oxides.
Catalytic cracker partial condenser.	Intimate mixture of iron oxides, iron sulphides polymerized organic and oil.
Ammonia condenser	Mostly iron oxides with small amount of oily sludge.

NOTE: See sheet 3 for references. Taken from the exclusive article, "Chemical Cleaning in the Refinery," by C. H. Groom, published in *The Petroleum Engineer*, April, 1948, pages 110 to 114, inclusive.

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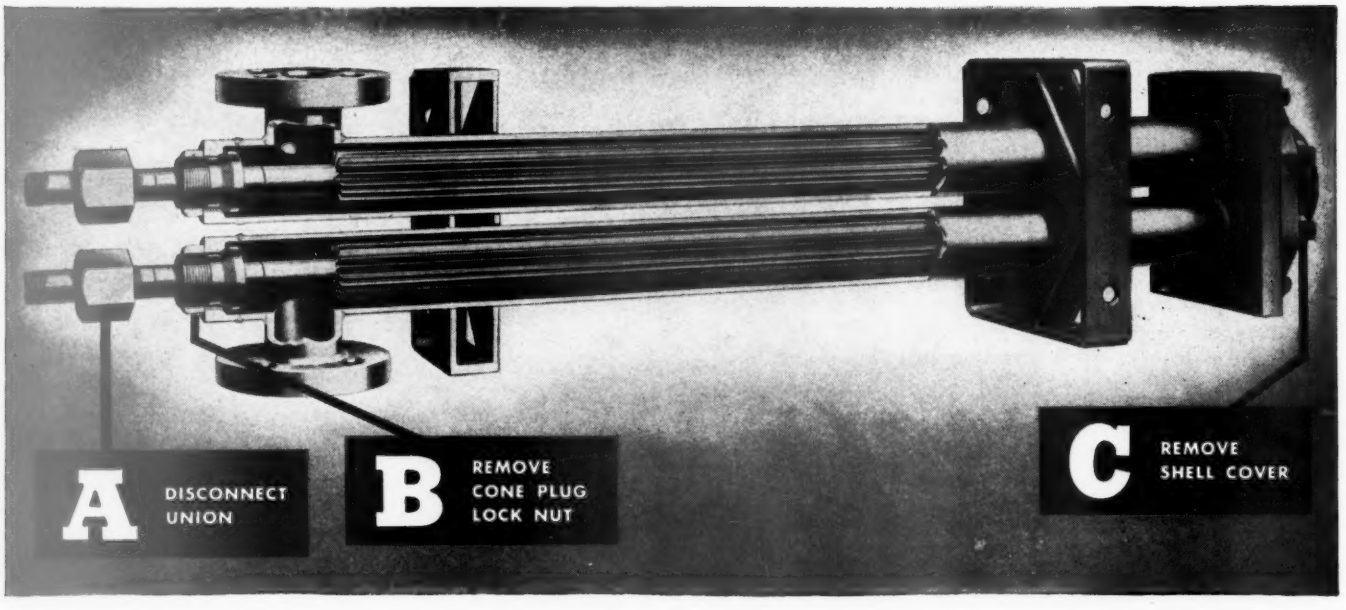

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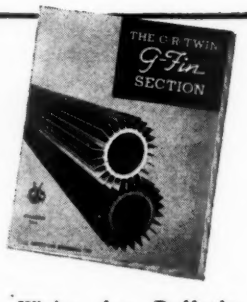

Write for Bulletin 1614, describing the many advantages and applications of the G-R Twin G-Fin Section.

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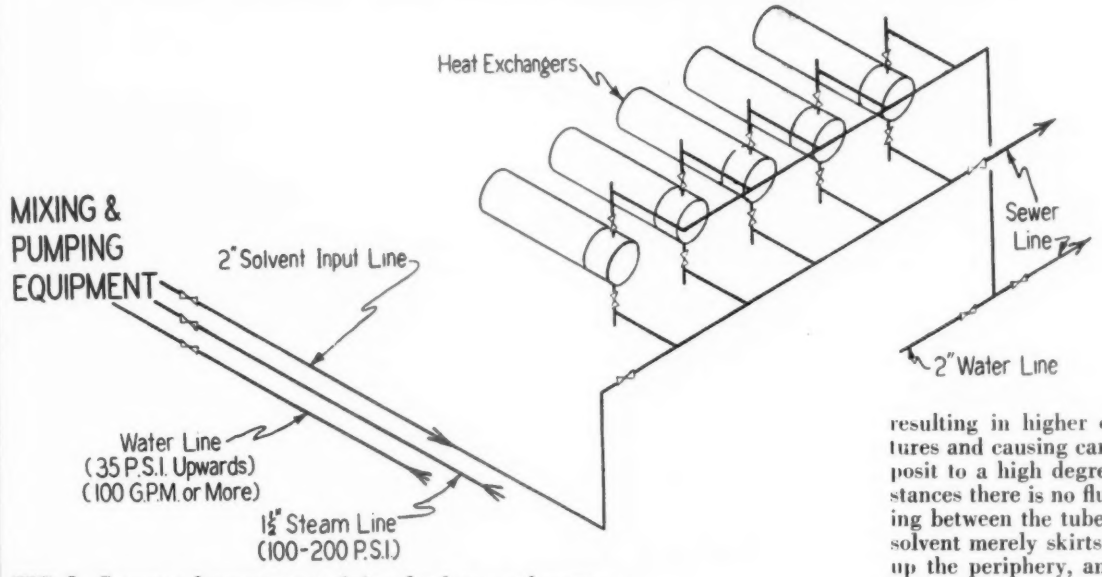
CHEMICAL CLEANING METHODS FOR REFINERY EQUIPMENT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MIXING & PUMPING EQUIPMENT
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Sewer Line
2" Water Line
Water Line (35 P.S.I. Upwards) (100 G.P.M. or More)
1½" Steam Line (100-200 P.S.I.)

FIG. 3. Suggested permanent piping for heat exchangers.

The available solvent discharge and return lines greatly affect the application of the solvent in that they govern the rate and safety at which the solvent can be handled. The best lines consist of 2-in. steel pipe. Due to the extensive areas over which various refinery units are distributed, piping is somewhat expensive, but if the piping is installed as permanent chemical cleaning equipment the cost is minimized. Fig. 3 illustrates a suggested permanent piping on tube and shell units to provide for chemical cleaning. It is elaborate but it enables the individual cleaning of any one unit, also allows ease of flushing and back flushing the units. Less elaborate modifications of this hookup will be found more practical on some installations. Where scattered, small volume units are involved, hose is applicable. In this regard, about the largest size hose, safe for handling the solvents at the pressures and temperatures involved, is 1¼ in. ID. Where it is necessary to use hose, the same sections of hose can be transferred from one unit to another.

The necessary solvent temperature is obtained by jetting steam directly into the solvent except when a non-miscible solvent is used. Hydrochloric acid always should be heated only by venting steam directly into the sections. It never should be heated by applying steam to the opposite side of the unit (that which does not contain acid during the cleaning operation) as the inhibitors will not protect effectively the metal on the acid under these conditions. The alkaline solvents may be heated either directly by injecting stem into the solvent or by any source of heat on the side of the unit not containing the solvent during the cleaning process.

Agitation of the solvent during the cleaning operation generally is obtained by recirculation as other means of agitation would require elaborate equipment either within or on the unit being cleaned. The main purpose of this agitation is to keep solvent of the desired concentration and temperature in contact with the scale deposit. Agitation by recirculation is necessary on inorganic deposits only where the unit volume is such that the ratio of solvent to scale deposit is low, as in heat exchanger tubes. Then it is only necessary to displace the spent solvent with fresh solvent at intervals. In the removal of organic deposits some type of agitation usually is required throughout the entire operation, either by recirculation, steam, air, or gas. This is due primarily to the fact that organic deposits generally are removed by dispersal in the solvent rather than entering into solution.

● **Summary.** In general, practically any inorganic scale deposit can be removed chemically, provided enough solvent and time are used; however, there are instances where the amount of solvent would be so great as to render the operation uneconomical. Any process side unit fouled with iron oxides and sulphides can be chemically cleaned and it may be said that, except for the highly carbonized deposits, most of the process side deposits also can be removed with chemical solvents.

The deposits encountered in the shell sides of tube and shell units on the process side are generally difficult to remove because as a rule the units are operated until the deposits become thick and crack off the tubes. The loosened deposits fall down into the bundle completely filling the annular space between the tubes, resulting in higher operating temperatures and causing carbonizing of the deposit to a high degree. In such circumstances there is no fluid passage remaining between the tubes and the chemical solvent merely skirts the bundle, cleans up the periphery, and never enters the bundle to any appreciable depth. The shell sides of units with relatively low operating temperatures probably could be cleaned effectively if they were operated for shorter times between the cleanings. But, even on those bundles that are tightly packed with scale, chemical cleaning can be used to an advantage in that the proper solvent will clean the periphery of the bundle allowing it to be pulled easily. Also application of the proper solvent when the bundle is in place results in changing the chemical and physical properties of the deposits so that they can be removed readily by hosing or mechanical means. As mentioned previously, highly carbonized scale deposits do not respond to the practical chemical solvents.

The use of solvents in cleaning refinery equipment is an additional tool for production and maintenance in the refinery. By recognizing its proper application and its limitations it is probably the easiest and most economical aid to efficient production and maintenance that is readily accessible to the refinery. An engineer trained in the recognition of the deposits, selection of the solvents and their application, using suitable equipment can perform a large amount of work in a relatively short time resulting in increased efficiency and economy of operation.

● **References.**

"Chemical Removal of Scale from Refinery Equipment," L. W. Lee, *Refiner and Natural Gasoline Manufacturer*, June, 1940.

"Chemical Descaling of Refinery Heat Exchange Equipment," G. F. Williams, *National Petroleum News*, April, 1943.

"Chemical Removal of Scale as a Factor in Speeding Production," *Oil and Gas Journal*, May 20, 1943.

"Maintenance of Tubular Heat Exchangers," J. G. Housman, *Petroleum Refiner*, July, 1947.

Taken from the exclusive article, "Chemical Cleaning in the Refinery," by C. H. Groom, published in *The Petroleum Engineer*, April, 1948, pages 110 to 114, inclusive.

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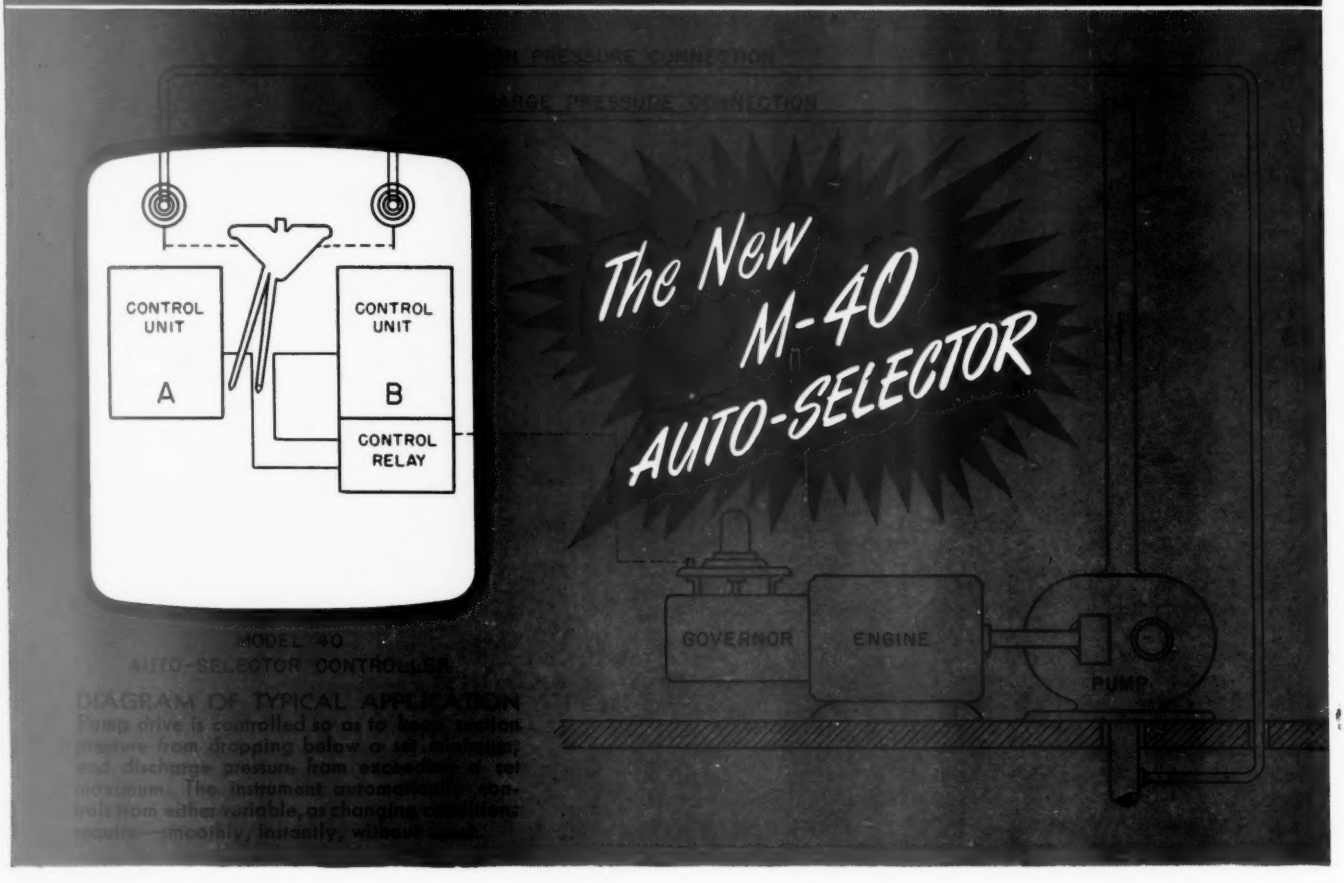

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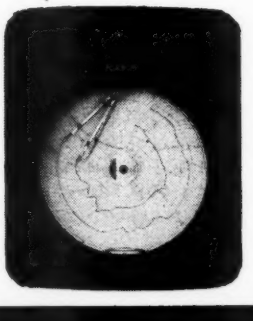

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Fuel Oil for Diesel Locomotives in Relation to the Supply of Petroleum*

THE outlook for future petroleum supplies is a matter of great importance because our vital transportation industries are dependent to a large extent upon some form of oil for power. Even though year after year new discoveries of petroleum have more than equaled the ever-growing demand, recent temporary local shortages of petroleum, particularly heating oils, have caused an increasing amount of public concern.

Our nation has become so dependent upon the Diesel locomotive because of its superior performance and its high operating economy that attention has been focused on the increasing use of Diesel fuels by the railroads. To evaluate the railroad liquid fuel requirements and to appraise the outlook for their continued future supply, it is essential to consider the amount of fuel used by the railroads in relation to the quantities used by other important consumers.

From analysis of the facts as presented in the following pages, I am confident that American industry has the resources and the ability to meet the growing fuel demands of our transportation industries, including the railroads, for a great many years to come.

C. F. Kettering

Fuel oil for diesel locomotives. The shortage of petroleum products, brought about by an unprecedented post-war demand, has naturally caused concern about the future supply of liquid fuels to serve the domestic needs of our country and to provide for the national defense in time of war. Difficulties in obtaining sufficient fuel oil for home heating in certain parts of the country aroused protests from many local, state, and federal officials and agencies. The publicity that was given to these protests singled out the diesel locomotive as one of the principal offenders in causing the fuel shortage. In fact, certain elements have contended that the expanding use of diesel power by the railroads has placed a heavy burden upon the refining capacity of the country and has further accelerated the drain upon our diminishing oil reserves. *The contentions are so misleading that it is imperative for the* guidance of national policy to bring out forcibly the true facts of the situation.

Consumption of petroleum products by the railroads.* In 1947, the total consumption of petroleum products in all fields of use was about 5,500,000 bbl per day. Of this total, *the railroads, according to Interstate Commerce Commission reports, absorbed some 317,000 bbl per day or 6 per cent as follows:*

	Bbl per day
Heavy fuel for oil-burning steam locomotives	265,000
Diesel fuel for all diesel-electric locomotives	52,000
Total	317,000

For the 265,000 bbl of heavy fuel, the oil-burning steam locomotives performed about 18 per cent of the work done by the American railroads. The diesel fuel consumed by diesel-electric locomotives in 1947 was 1 per cent of the total consumption of all petroleum products. For these 52,000 bbl of diesel fuel per day, the diesel-electric locomotives performed about 19 per cent of the work done. The rest of the work, 63 per cent, was performed by coal-burning steam locomotives and electric locomotives using central station power, much of it coal generated.

If all the work done on the American railroads in 1947 had been performed by diesel-electric locomotives, the total consumption of diesel fuel would have been about 256,000 bbl per day. This amount is less than 5 per cent of the total consumption of petroleum products in all fields in 1947, *and is less than the quantity of heavy fuel consumed by the oil-burning steam locomotives in 1947.*

Consumption of petroleum products in other fields. According to the reports of the Bureau of Mines and American Petroleum Institute, automobiles, trucks, buses, farm tractors, and airplanes, which consumed approximately 2,000,000 bbl of gasoline per day in 1947, collectively are the principal users of petroleum products. Users of residual fuels and asphalt consumed about 1,550,000 bbl daily. The oil home heating equipment took about another 580,000 bbl per day. Altogether, the 1947 liquid fuel consumption was divided as shown in Fig. 1.

Much of the misunderstanding concerning the overall fuel situation has come about from the argument that diesel-electric locomotives consumed 633 per cent more fuel in 1947 than in 1941. Yet this 633 per cent represents an increase of from 7,100 bbl per day to 52,000 bbl daily or a net increase of 44,900 bbl per day. Meanwhile over the same period, the increased consumption by other users of liquid fuel was as shown in Fig. 2.

The increased consumption of petroleum products between 1941 and 1947 by all users other than railroads totaled 986,000 bbl per day. The 44,900 bbl daily increase in diesel fuel consumption by American railroads is by comparison but a drop in the bucket.

The case for the diesel locomotive. The railroads of our country are recognized as an indispensable facility for the well being of industry, agriculture, and communication without which present standards of living would be impossible. They are also a vital necessity for the national defense in time of war. To say that the railroad industry should continue to supply such facilities without an adequate financial return is to expect the impossible.

Yet the railroads are confronted with a rigid income and expense structure. They cannot offset rising costs of material and labor by increasing the price of their services, until approval is obtained from regulatory bodies because of strict government regulation of rates. Such approvals, if granted, have customarily lagged far behind the conditions that required them. The railroads must also deal with powerful unions in their wage agreements. These unions have yet to fail in obtaining ever-rising wages entirely apart from work done or services rendered.

The net effect of these rigidities and other factors, on the railroads' financial structure over the past 20 years has been disastrous. During the decade of the 30's, one-third of the railroads were insolvent and in receivership.

*Report by Electro-Motive Division and Research Laboratories Division of General Motors Corporation.

*Class I railroads including switching and terminal companies.

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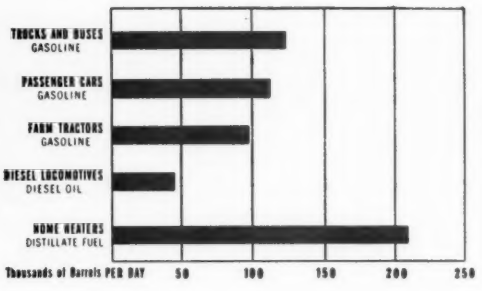

Fig. 1

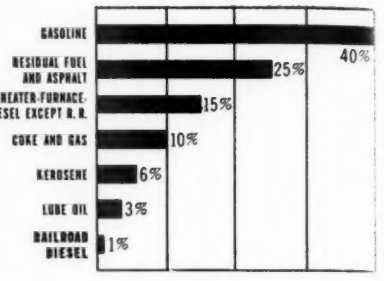

Fig. 2

Over the 20-year period, a net return on invested capital of slightly over 3 per cent per year for all railroads has been insufficient to attract new capital for improved services and the extensive modernization of facilities.

Until the diesel locomotive arrived on the scene in 1936, the railroads appeared powerless to accomplish the rehabilitation of their properties and the reorganization of their finances within the limitations imposed by government control of income and union control of wages. Predictions were rife that the railroads of America were headed for outright government ownership. Today, the picture is quite different.

So effective have diesel locomotives been in reducing operating costs and improving services *that they have literally paid for themselves out of direct savings over steam operation* while at the same time they have built increased traffic and revenue for the railroads. The Zephyrs, Rockets, Streamliners, Chiefs, and a host of other diesel-powered passenger trains have converted many losing services into highly profitable ones. Schedules from Chicago to the Pacific Coast have been reduced from 53¾ hr to 39¾ hr by the use of diesel power.

In switching service, diesel locomotives during the year 1947 performed over 32 per cent of the switching work done at savings up to 40 per cent per annum on their first cost. In mainline freight service since 1940, diesel locomotives have taken over the heaviest and fastest freight movements with savings up to 25 per cent per annum on their first cost. Ofttimes, because of higher speeds, the ability to haul longer trains, and greater availability, one diesel locomotive will replace between four and six steam locomotives.

The two principal ways by which diesel locomotives effect direct economies over steam are in fuel consumption and in repair costs. In 1947, according to the Interstate Commerce Commission reports, the total fuel bill for steam locomotives was approximately $582,000,000 for coal and fuel oil combined. Had the work performed by these steam locomotives been handled by diesel locomotives at the same cost recorded by diesels then in operation, this fuel bill would have been more than cut in half with savings of $340,000,000.

During the year 1947, the railroads spent $527,000,000 on the repair of steam locomotives. Based on the maintenance and repair costs of diesels then in service, 40 per cent of this amount, or $210,000,000 could be transferred from operating expense to earnings by complete dieselization. The combined savings in fuel and repair costs for the year 1947 would have totaled $550,000,000. Such a contribution to earnings is sufficient to increase the average return on total railroad investment from 3 per cent to 5 per cent and would do much to encourage continued investment in better railroad plant and facilities with which to provide improved transportation services at the most economical cost.

Not only does the diesel locomotive provide means for substantial improvement in railroad service and financial structure as outlined above, but it is the most efficient and economical way to transform liquid fuel into useful work. Diesel locomotives haul goods with five times the fuel efficiency of steam locomotives. When hauled by diesel locomotives a loaded freight car weighing 40 tons, or more than 20 times the weight of the modern automobile, travels 16 miles per gallon of diesel oil at an average speed of 22 miles per hour. Thus in the whole vital overland transportation service real conservation of our petroleum resources would be accomplished by dieselization of our railroads. In contrast, home heaters obtain practically the same heating efficiency with coal as with oil. Thus the substitution of oil for coal in home heating reduces the liquid fuel reserves without any offsetting gain in efficiency.

▷ **What about the future?** We, who have pioneered the manufacture of diesel locomotives for the American railroads, are just as interested in the future of the liquid fuel situation as anyone in government, industry, or the general public. The deficiency in

supply of petroleum products is just as real as that in steel, meat, or newsprint under conditions of abnormal usage. We earnestly support any proposals for the relief of this condition and for the conservation of our petroleum reserves, which are for the greatest good of the greatest number of our people.

Specifically, in order to obtain an increase in the supply of liquid fuel, the oil industry must expand its refinery capacity with modern equipment capable of getting the most fuel possible out of a barrel of crude oil. This need has been recognized by the oil industry and *additional refining capacity is being provided* just as fast as equipment can be procured, requiring an investment running into billions of dollars. Therefore, there is great risk in formulating any long-term transportation policies based upon conditions that we have every right to believe will be of short duration.

The consumption of gasoline by automobiles, trucks, buses, and airplanes in 1947 has doubled since 1930. Not only has the number of vehicles increased, but in the case of automobiles the consumption of gasoline per car per year has increased from about 500 gal to about 700 gal. This is due to increased annual mileage and to the increased average age of cars in use.

If the miles per gallon of existing cars and trucks could be increased by just one mile per gallon, the saving in gasoline consumption would amount to about 150,000 bbl per day. Slower driving speeds alone would provide this much economy. Diversion of 150,000 bbl per day of cracking stock to produce diesel fuel would provide three times the total 1947 railroad requirements.

But an attack on the fuel economy problem, more fundamental than reduced speed, is needed. General Motors has long been working on the development of high compression engines to use high octane gasoline. These developments have progressed to the point where engines capable of 40 per cent fuel savings will ultimately become available. The problem of manufacturing sufficient quantities of high octane gasoline and the problem of distribution are of such magnitude that progressive steps must be taken to reach this ultimate goal. Test automobiles with engines producing an immediate fuel saving of 20 per cent have been in operation for hundreds of thousands of miles. While it is recognized that the fuel savings on a national basis will be directly proportional to the number of automobiles placed in service with engines of this advanced design, nevertheless, the

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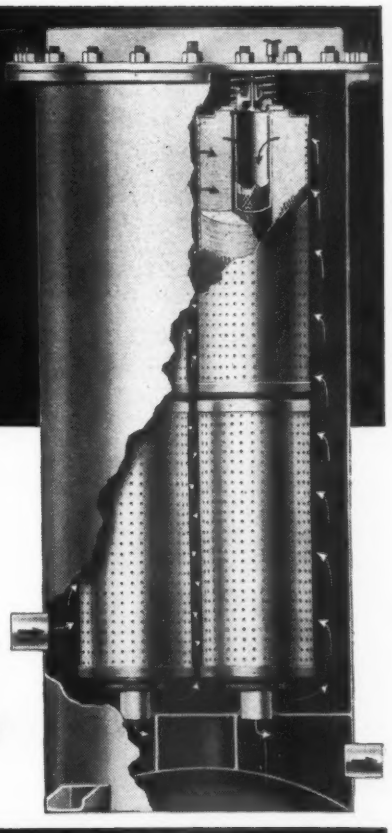

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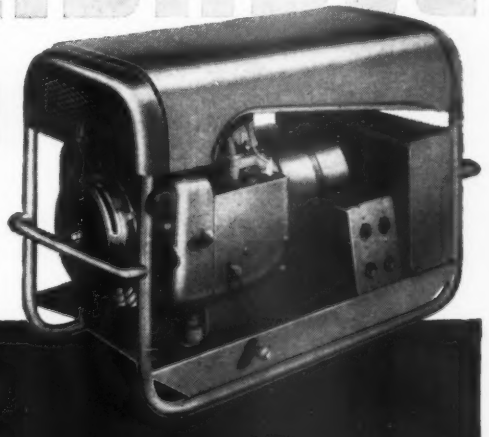

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potential savings aggregate 400,000 bbl of gasoline per day, which is equivalent to eight times the amount of diesel fuel consumed in 1947 by the American railroads.

The living habits of our people and the economy of our country are permanently geared to the use of automobiles and trucks. Progress can and will be made in improving efficiency and reducing consumption in this field through technological developments in both the automotive and petroleum industries. However, it must be admitted that the eventual exhaustion of our oil reserves when and if it occurs will be due in large measure to fuel usage by these machines. In anticipation of this eventuality, it must be expected as a matter of national necessity that effective means will be developed in the near future to produce synthetic liquid fuels economically. When this is done, it is not too much to expect that the small additional capacity required to supply diesel fuel for railroad consumption will also be provided.

▸ **Conclusion.** It has been stated by some leaders in both government and industry that the shortage of liquid fuels and the huge availability of coal warrant the adoption of a transportation policy favoring the continued use of coal-burning steam locomotives by our railroads instead of diesel-electric ones. Emphasis is laid upon the vulnerable position of the nation at war, our limited oil-refining capacity, and the tremendous drain upon our limited oil reserves, through the years from progressive dieselization of railroad services.

It has been shown that this national policy, if adopted, would actually increase the use of liquid fuel unless both oil-burning steam and diesel locomotives now in use were disposed of and the entire railroad operation conducted by coal-burning steam locomotives. If such a backward step were seriously contemplated, a review should be made of the transportation problems during World War II and how they were solved. Diesel freight locomotives, because of higher speeds, the ability to move heavier tonnages, and their greater availability for work, handled as much war freight on the trunk lines west of Chicago as could have been handled by an additional newly built railroad from Chicago to the Pacific Coast using steam power alone. So effective was the war work performed by the diesel freight locomotive that its manufacture commanded the highest priority on steel and production was continued at capacity throughout the war in spite of the acute shortage of both manpower and material.

For many years, it has been estimated that our proved oil reserves would be depleted in 12 years. While the use of petroleum products is at an all-time high, the discovery of new fields has more than kept pace with current demands so that proved reserves have been steadily increasing. If all the diesel-electric locomotives in operation on the American railroads today were to be scrapped tomorrow, *this 12-year reserve would be extended less than 45 days.* Assuming 100 per cent railroad dieselization as of today, the oil reserves would be depleted just 7 months earlier.

Certainly, the demonstrated need of our country for an efficient transportation system, and the requirements of our railroads for sufficient earnings to keep them sound and healthy warrant the use by our railroads of the most modern cost-savings tools and equipment that exist or can be developed. That the diesel-electric locomotive is so regarded may best be shown by the fact that railroads which own the most productive coal mines for the supply of their coal-burning steam locomotives are among the leaders in the rate of replacement of their steam locomotives with diesel power.

To insist that the railroads invest their money in coal-fired steam locomotives, which were recognized as obsolete 10 years ago in the light of the foregoing conditions, is like asking the automobile companies, because of the shortage of steel and fuel to return to the manufacture of carriages and wagons. That cannot happen and will not happen, or will it happen to the railroad industry, regardless of the temporary pressures that may be brought to bear upon it?

* * *

Death takes Emil R. Gasser

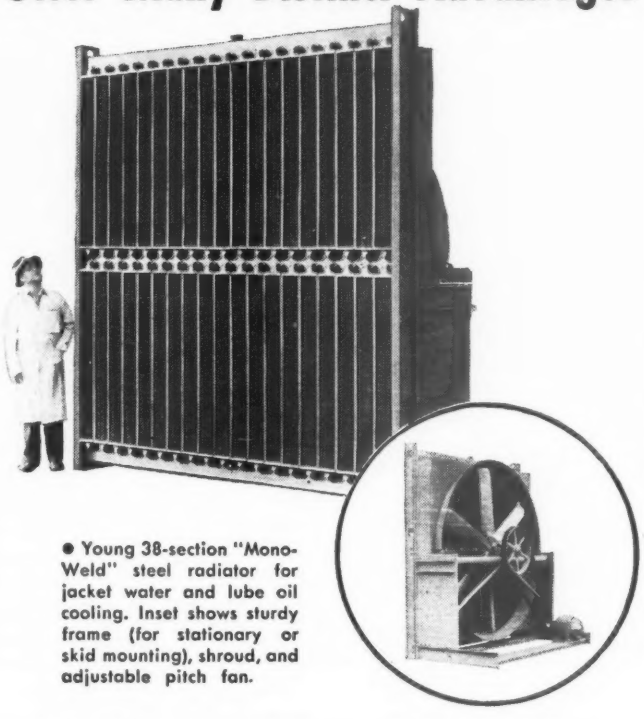
Emil R. Gasser, age 44, chief physicist of Farrel-Birmingham Company, Inc., died suddenly September 5, at his home in Buffalo, New York.

Emil R. Gasser

Gasser was first employed by Farrel-Birmingham in 1928 and, for the past three years, was director of research activities with headquarters at Buffalo. For work in development of propulsion gearing and related design during World War II, he was awarded a citation by the Navy Department.

Gasser was born and reared in Switzerland. He was educated in schools in Schaffhausen and Zurich and he first came to the United States in 1925.

"MONO-WELD" SECTIONAL RADIATORS BY YOUNG Offer Many Distinct Advantages



• Young 38-section "Mono-Weld" steel radiator for jacket water and lube oil cooling. Inset shows sturdy frame (for stationary or skid mounting), shroud, and adjustable pitch fan.

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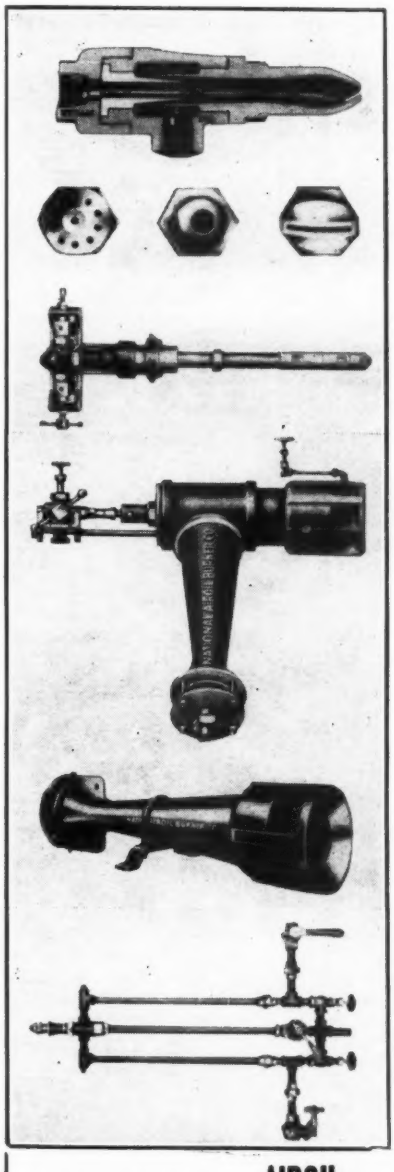

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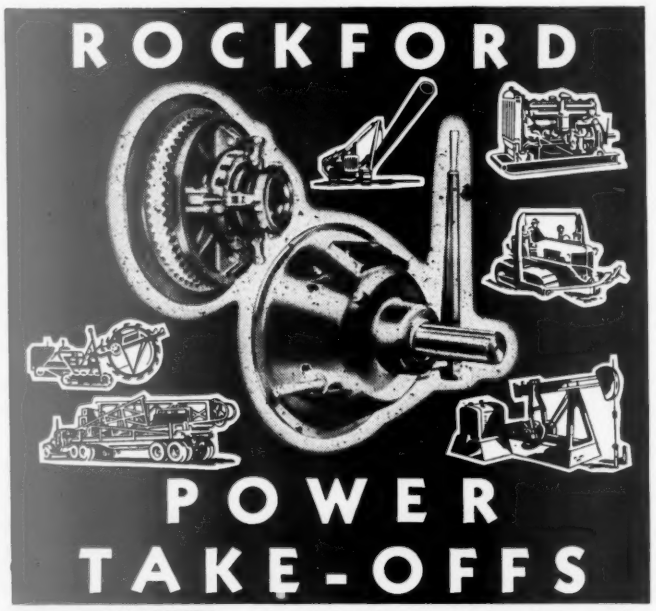
Name California representative

The Cypher System Inc., Long Beach oil well electrolysis control firm, recently announced the appointment of Technical Service Company as its exclusive California representatives. The Technical Service Company was organized by Warren Woodruff, president, in May, 1946, to handle products of a technical nature for the producing departments of the industry. The organization is composed of a service manager, Tom Homer with headquarters in Los Angeles Basin, and Henry Dobie at Bakersfield, who handles the San Joaquin Valley sales and service. Woodruff received his Engineers degree from the University of Southern California where he majored in electrical engineering. Upon graduating he spent several years with General Electric Company. He returned to the oil industry in 1938 when he went to work for the Union Oil Company at Santa Fe Springs. Shortly after Lane-Wells entered the electric logging field he joined that organization and eventually became district superintendent at Bakersfield.

Homer joined the company in July, 1947. His oilfield background dates to 1932 at which time he went to work in the Venice oil fields. He later joined Pat Elliott on the Geoanalyzer. When Lane-Wells purchased this company Homer went over to their organization. After covering most of their California districts as assistant district superintendent, he was promoted to California operating superintendent, which position he held at the time he left Lane-Wells to join Technical. Henry Dobie who handles sales and service in the San Joaquin Valley went to work in the oil fields in 1922 and has spent the last 14 years in sales and service work. He formerly worked for Halliburton Oil Well Cementing Company and held the position of sales engineer for Lane-Wells at Bakersfield the last five years.



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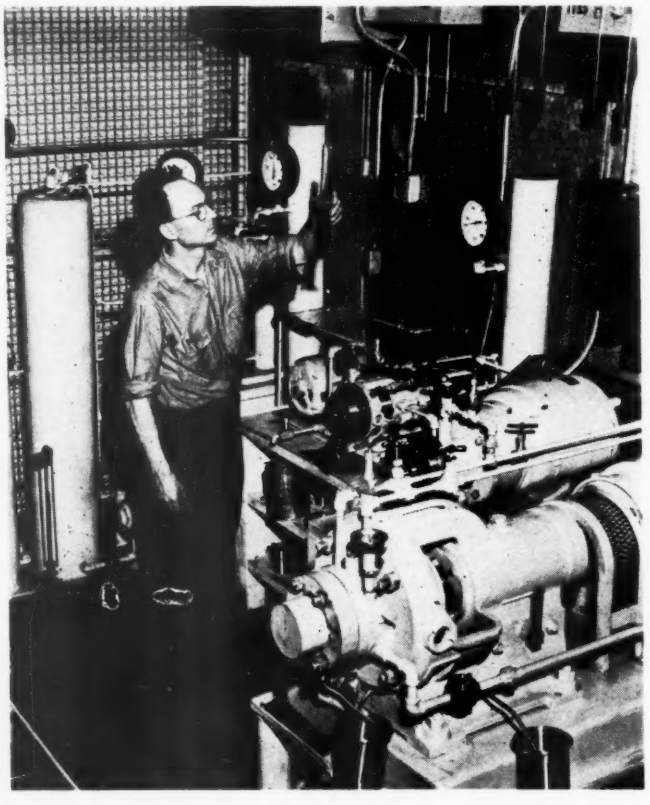
A complete mechanical seal experimental and testing lab is operated by the Pump Division of the Byron Jackson Co., Los Angeles, California. All mechanical seal experimental runs as well as routine tests of seals prior to installation, are made in this lab under Wes Shone, inspector.

Testers have been so designed that all seal sizes from 1 in. to 4½ in. can be assembled and run within a short period of time. Each seal face is carefully lapped, inspected under a flat, and then installed in a tester. Seal oil pressure is supplied by an automatic pressure system capable of operation between 0 and 1000 psi. Isolating tanks connected to this system permit testing with water as well as special lubricants, with the same range of pressures. Cooling jacket water is supplied by the BJ Bilt-on pump. Flow indicators are placed in each cooling jacket line.



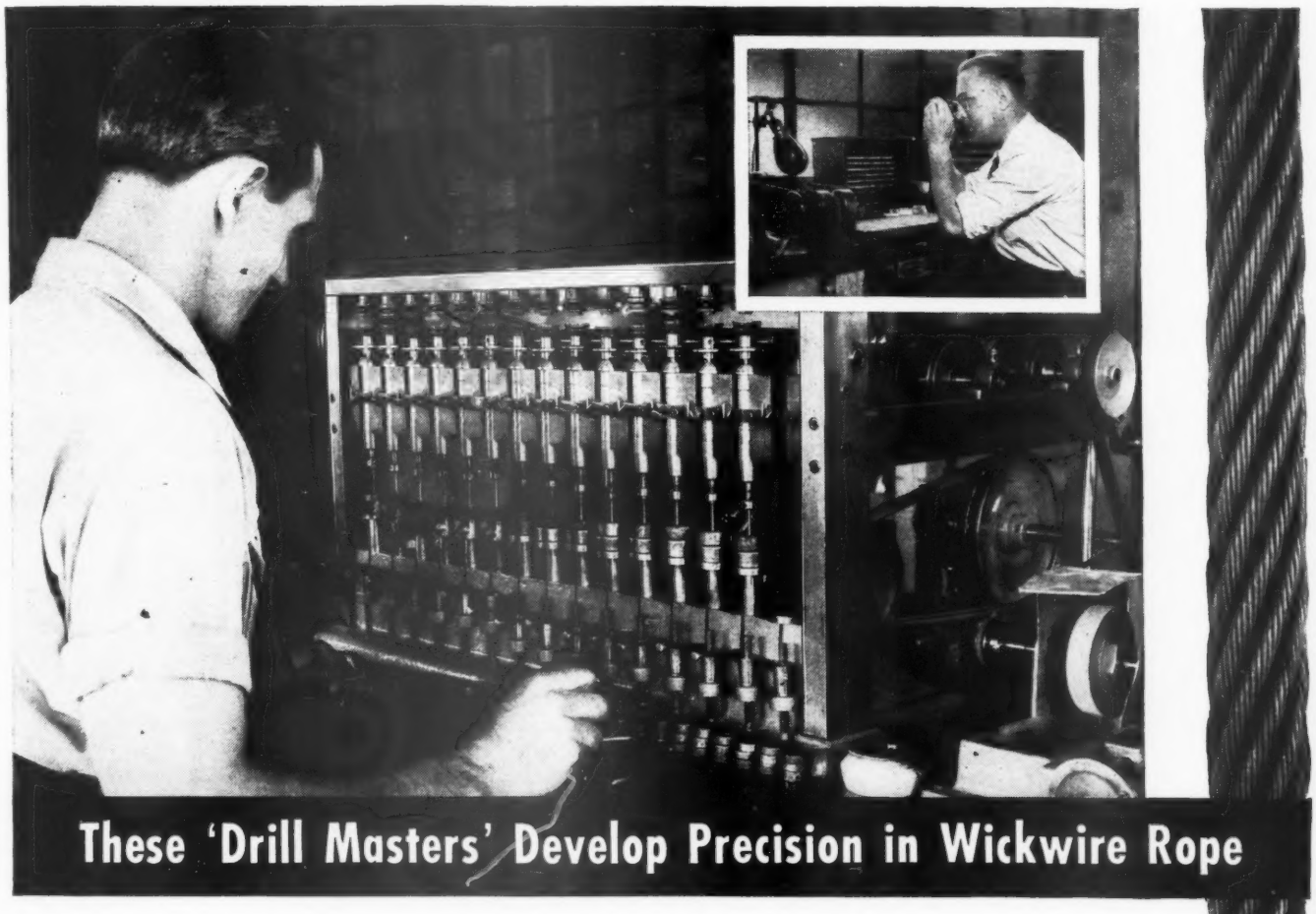
Leakage is carefully recorded, together with the length of the run, seal oil temperature, and the essential information describing the type of seal under test. At the end of each run, leakage is converted into terms of gallons per year. The seals are re-inspected and either approved or rejected for installation. In the event the run is experimental, results show how the materials of the seal stand up under various temperatures, fluids, and operating conditions.

Shell Chemical moves offices

The administrative offices of Shell Chemical Company, recently transferred from San Francisco, have opened in quarters occupying four floors of a new building at 4 West 58th Street, New York, according to Jan Oostermeyer, president. The company manufacturers and markets petroleum-derived chemicals and chemical intermediates.

Approximately 115 administrative and staff employes and their families were involved in the move from the west coast offices. The company's western sales division office will remain in San Francisco.

From the New York office, Shell Chemical will continue to direct the operation of its plants in Houston, Texas, and in Martinez, Dominguez, and Pittsburg, California.



These 'Drill Masters' Develop Precision in Wickwire Rope

The workability and durability of wire rope is largely dependent upon accurate coordination of each wire in the rope. Because off-size wire can cause excessive friction and internal rope wear and early failure in service, every wire must be perfect in shape to fit into the exact geometric construction pattern of the rope.

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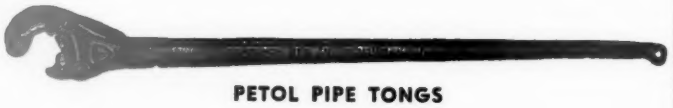

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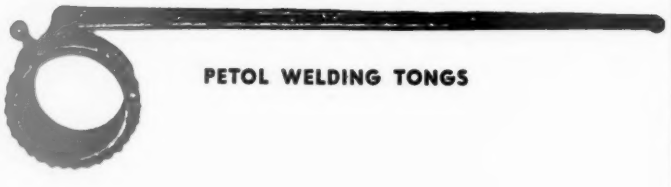

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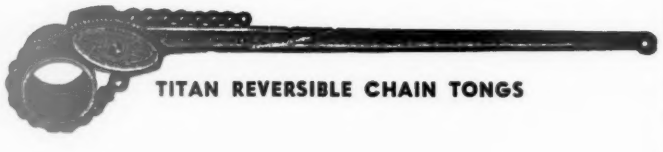

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Graham named manager

A. H. Graham has been appointed manager, General Electric's d-c armored motor engineering division, small and medium motor divisions, Erie Works, it has been announced by W. H. Henry, manager, small and medium motor divisions.

Graham was graduated from West Virginia University in 1938 with a B. S. degree in electrical engineering. He joined General Electric on the test course the following year. Later he worked on the design and development of traction generators and motors, and during World War II was involved with the design and development of propulsion motors, and generators for diesel-electric powered mine-sweepers, net tenders and fleet tenders. Later still he was involved with the design and development of generators for use on diesel-electric road locomotives, motor-generator locomotives, and the experimental gas turbine locomotive. Graham has been section engineer, design section, d-c armored motor engineering division, since September, 1947.

Thermoid's Nephi, Utah, plant

The large, modern plant of the Thermoid Company at Nephi, Utah, is now approaching 75 per cent operation, according to an announcement by president Fred E. Schluter.

Industrial belts (conveyor, transmission and V), hose of all kinds, including rotary and wire braid hydraulic, molded products for the oil fields, and fan belts and radiator hose for the automotive trade will be manufactured in this new modern unit.

Thermoid's decision to establish its new factory in Utah was twofold. The first consideration was Utah's convenient location in relation to the main West Coast city markets, and the oil and mining centers of the southwest and mountain areas. Second, the excellent manpower available assured efficient production of technical products to maintain superior Thermoid standards.

This modern factory at Nephi, Utah, represents the fourth manufacturing unit of the Thermoid Company. In addition to the main plant at Trenton, Thermoid operates a large asbestos textile factory at Charlotte, North Carolina, and their Canadian subsidiary at Welland, Ontario, where more than 90 per cent of all hard rubber battery cases used in Canada are produced.

FWD accelerates development

Announcing a number of changes of personnel in its engineering division The Four Wheel Drive Auto Company this month told of an acceleration in its development program, both modernization of its present standard models and development of new models.

Donald B. Olen, formerly chairman of the manufacturing committee, has been named director of the engineering division and H. B. Dodge, former director has been elevated to technical advisor to the management of the company. G. D. Simonds, formerly manager of design engineering has been named chief engineer in charge of design of standard FWD models.

B. G. Donley is manager of development engineering concentrating his efforts on specialized products.

New research center

Stanolind Oil and Gas Company will soon begin the construction of a new and larger research center at Tulsa, Oklahoma, E. F. Bullard, company president, has announced. A 60-acre site at the southwest corner of 41st and Yale in southwest Tulsa has been purchased and construction will begin the latter part of this year. The new center is expected to be ready for use early in 1950.

George Roberts, Jr., is manager of the research department. Exploration research is under the supervision of Daniel Silverman; J. B. Clark is in charge of research on production of oil and gas; Scott W. Walker directs the chemical process research, and Paul F. Hawley is in charge of patent work.

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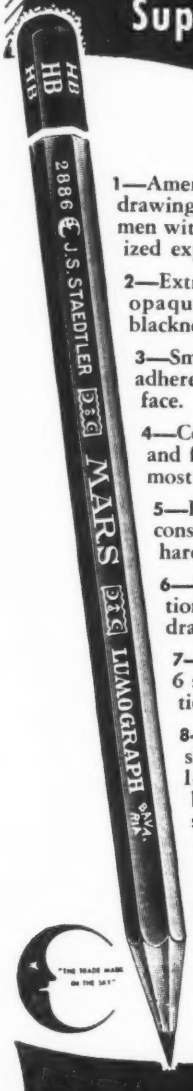

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▸ **Claude E. Swift** has been elected vice president in charge of research and patents for Union Oil Company. Previously, Swift had been manager of research and patent counsel. Swift joined Union Oil Company in 1926 as a senior inspector in the research department at the company's Wilmington refinery. He became a junior chemist in 1927 and an assistant chemist in 1930. He was appointed chemical engineer in the patent division in 1930; patent engineer in 1934, patent attorney in 1935, assistant patent counsel in 1938, and patent counsel in 1939. He served as patent counsel from 1939 to 1947. On July 1, 1947, he was appointed manager of research and patent counsel.

C. E. Swift

▸ **Serge B. Jureney** was appointed manager of Continental Oil Company's coordinating and planning department, it was announced by President L. F. McCollum.

"This department is being created to coordinate various activities of the company and to develop financial plans and programs," said McCollum.

Jurenev relinquishes the office of treasurer, but continues as secretary.

▸ **Harvey W. Smith** has joined the engineering staff of Lenkurt Electric Co., San Carlos, California, manufacturers of telephone and telegraph carrier equipment for wire-line and radio application. In full charge of design and construction of high-quality transformers both for carrier application and custom manufacture, Smith will draw on his background as an independent consultant and as chief engineer at Peerless Electrical Products Company, and Robert M. Hadley Company, both of Los Angeles, and Glenn-Roberts Company, Oakland, California. He has also been a member of the engineering staffs of Bendix Aviation Ltd., Hollywood; Audio Products Company, Burbank, and Electrical Research Products, Inc., Hollywood.

H. W. Smith

▸ **E. (Ed) L. Behrends** has joined the general sales department of Taylor Forge and Pipe Works, which operates plants at Chicago and Carnegie, Pennsylvania. He formerly was vice president of George B. Limbert Company, and later became manager of the Western Supply Division of the Lummus Company operating the Limbert facilities.

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On Peerless combination drive pump heads there is always an *extra* power source. The combination of the Peerless Gearturbo (right angle drive) and Moturbo (direct-connected electric) heads provides the double protection of a continuing flow of your water supply in case of power failure, *all in one space-saving installation.* The Gearturbo utilizes power from stationary engines through means of a right angle horizontal drive geared to the vertical pump shaft. The Moturbo is a direct-connected head with electic motor. Power can be transmitted to pump from either source and can be switched swiftly and easily.

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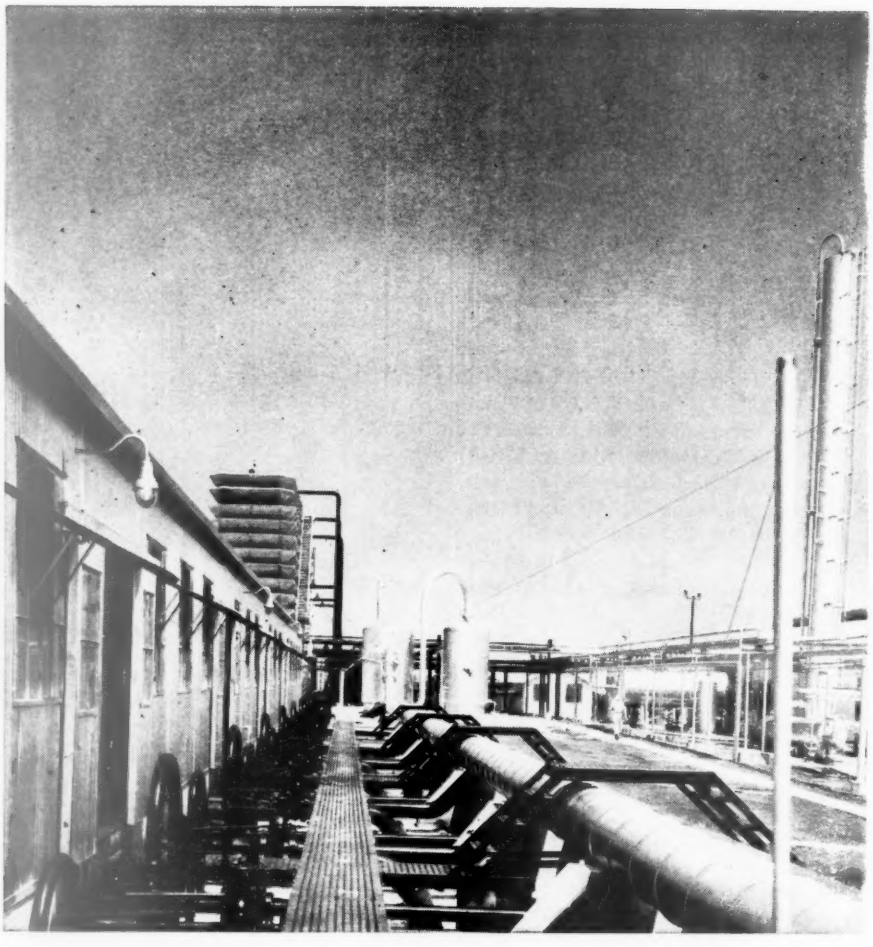

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Extra strength and safety have made Naylor the stand-by for gas and oil lines, gas and oil gathering lines, water lines, sludge lines, *vacuum lines*, siphon pipe, tank gauge and tank swing pipe, and threaded surface casing.

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Seiler advanced

John G. Seiler has been elected executive vice president of Tube Turns, Inc., Louisville, Kentucky. Seiler, who is a native of Louisville, became associated with Tube Turns, Inc., on February 24, 1930. A year later he was appointed sales manager. He was made vice president at the beginning of World War II, and general sales manager on February 14, 1945.

John G. Seiler

Seiler is a member of the executive board of the American Supply and Machinery Manufacturers' Association, and a member of the American Welding Society, Drop Forgings Association, Army Ordnance Association, International Acetylene Association, American Standards Association, and the American Society for Metals.

Adds to staff

Another large increase in the branch and regional sales and service staffs of Brown Instrument Company has been announced by William H. Steinkamp, field sales manager of the industrial instrument division of Minneapolis-Honeywell Regulator Company. The additions to the sales and service staffs and the cities to which each engineer has been assigned were announced as follows:

Atlanta: G. L. Ferguson assigned as a sales engineer.

Baltimore: Wayne Cook and Carl Lower assigned as service engineers.

Boston: Warren N. Smith and Albert E. Phillips assigned as service engineers.

Charlotte: W. Williamson, Jr., assigned as a service engineer and R. J. Holt as sales engineer.

Chicago: Bernard Fuller and Ormond Herring assigned as sales engineers.

Cleveland: R. Schumaker, sales engineer.

Denver: Robert Koening, service engineer.

Detroit: W. DeWolf, service engineer.

Dallas: Robert Harris, Jr., sales.

Houston: C. D. Walker, sales.

Indianapolis: Barry Coleman and Robert Thomas, service engineers.

Los Angeles: Richard Corbin, service, and Ralph Imbrogno, sales.

New York City: A. Godfrey, sales, and Ernest P. Lang, William C. Meyer, and Edward J. Roach, service.

Philadelphia: A. L. Rogers, Jr., sales, and Albert T. Collins, Joseph Facer, and Edward A. Lytle, service.

St. Louis: Keith H. Webb, service.

Syracuse: Richard Caviniss and George Wilson, service.

Washington, D. C.: John R. Shea, service.

Kansas City: D. W. Rees, service.

Omaha: H. C. Klug, sales.

East Orange, N. J.: William Harris, sales.

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Clear reading with raised numerals and graduations. Accurate to .001 inch. Corrosion-proof. Last a lifetime.

Numerals read up or down, as desired, in feet, either decimal scale to 0.01 feet or inches to 1/8".

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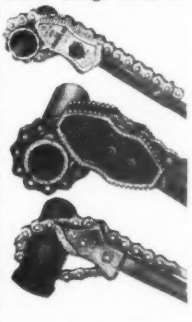

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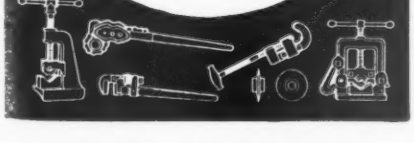
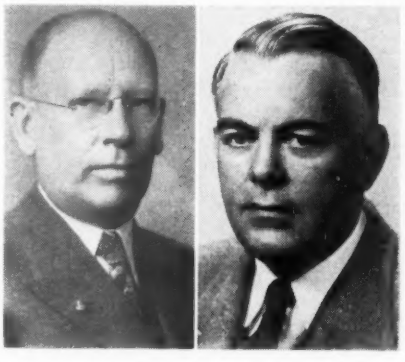


O. D. Donnell retires

Otto D. Donnell, for many years president and director of The Ohio Oil Company, retired recently from the board of directors, thus ending more than 42 years active association with the Company, He retired as president of the Company last May.

C. Z. Hardwick, vice president of the Company and manager of refining and marketing operations, was elected to the board of directors to fill the vacancy.

Donnell joined Ohio in 1906 after his graduation from Case Institute of



O. D. Donnell C. Z. Hardwick

Technology. Fully prepared by positions of increasing responsibility, he was elected President in 1927.

Under Donnell's presidency The Ohio Oil Company has prospered and expanded. In particular, his tenure has been characterized by advances in employe and public relations.

Hardwick, the newly-elected director, is a native of Bluffton, Ohio. After graduating from International College, School of Commerce, Fort Wayne, Indiana, he joined The Ohio Oil Company as a clerk in the Haynesville, Louisiana, office in 1921. He became manager of the refining and marketing department and was elected vice-president of the company in 1945.

Representatives named

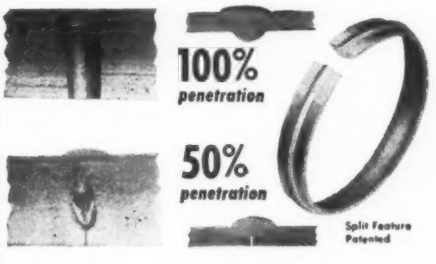
It has been announced by Federal Telephone and Radio Corporation, Clifton, New Jersey, associate of International Telephone and Telegraph Corporation, that Earl Lipscomb Associates of Houston and Dallas, Texas, will represent Federal's wire transmission and transformer division in the Southwest United States. This trade area will include the states of Texas, Louisiana, Oklahoma, Arkansas, and New Mexico.

Earl Lipscomb is well known in the Southwest territory as a result of 15 years with Western Union as transmission supervisor and five years as a consulting engineer. The services of his company will be devoted to the carrier systems field in the Southwest.

The offices of Earl Lipscomb Associates are at 4433 Stanford Street, Dallas, and 511 Petroleum Bldg., Houston.

Many NOW *use* THIN WALL PIPE *and* **SAVE MONEY** *by welding joints with* **WEDGE** *Split* CHILL RINGS

At one time it was impossible to use THIN WALL pipe because of the joints. The WEDGE Chill Ring with the patented SPLIT Feature has changed this. WEDGE Chill Rings REINFORCE the joints making them the STRONGEST part of the line—in case of shock,



strain or vibration the pipe will fail before the reinforced joints. WEDGE Chill Rings save money in many ways —the cost is less—the lighter weight not only reduces freight expense but the lines can be laid faster. If you weld pipe or refinery lines it will pay to investigate.

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Domestic Training Program for young Graduate Engineers prior to foreign assignment.

Career employment opportunities. Board and Room furnished. Vacation in U. S. with salary end of each 24 month period. Benefit plans.

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Address Box 90, c/o THE PETROLEUM ENGINEER, P. O. Box 1589, Dallas, Texas.

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Operator, Refinery and Chemical Plant

Must have operating experience, be able to prepare operating instructions, prepare schedules for plant start up and plant shut downs and have knowledge of plant processes. Must be able to handle labor problems. Should have equivalent to five or six years experience in operations. Address replies Box 89, % The Petroleum Engineer, P. O. Box 1589, Dallas, Texas.

IMMEDIATE DELIVERY!!

One D-13,000 and One D-4600 Caterpillar Electric Sets, 220 Volt, Three Phase, practically new. CLANCY LUMBER COMPANY, Inc., Grayson, Alabama.

Nikoh to show 6-in. line pipe at API meeting

Arrangements have been made to demonstrate to the petroleum industry the Nikoh method of producing 6-in. line pipe during the API convention in Chicago. The Nikoh Tube Company plant has the only pipe mill of its kind and size in operation in the United States, according to Harry J. Mokate, vice president. Other manufacturing facilities will also be shown, for making welded steel tubing from ½-in. to 4-in. diam, and welded steel pipe from ½-in. to 6-in. diam.

Special transportation is being provided to leave the Stevens Hotel at 11 o'clock on the morning of November 10, for the benefit of API conventioneers. Guests of the Nikoh Tube Company will be invited to remain for luncheon.

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Applications for employment from qualified oil field personnel are solicited. Those accepted will enjoy the security of key positions now and rapid advancement in our expanding field service division. Write or phone Welex Jet Services, Inc., 3909 Hemphill St. (Phone 4-3247) Fort Worth 9, Texas.

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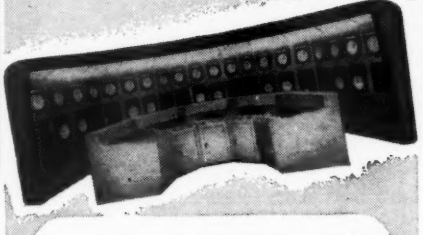

. . . like the admirable Falstrom CONTROL CENTER shown here! This is indeed the last word in modern instrumentation—suited to the finest and newest petroleum cracking plants or power installations.

. . . yes, nothing but an actual visit to this western control station can convey the sense of its sweeping beauty and painstaking construction.

. . . but we have tried to picture it for you in our Bulletin 126—write for it.

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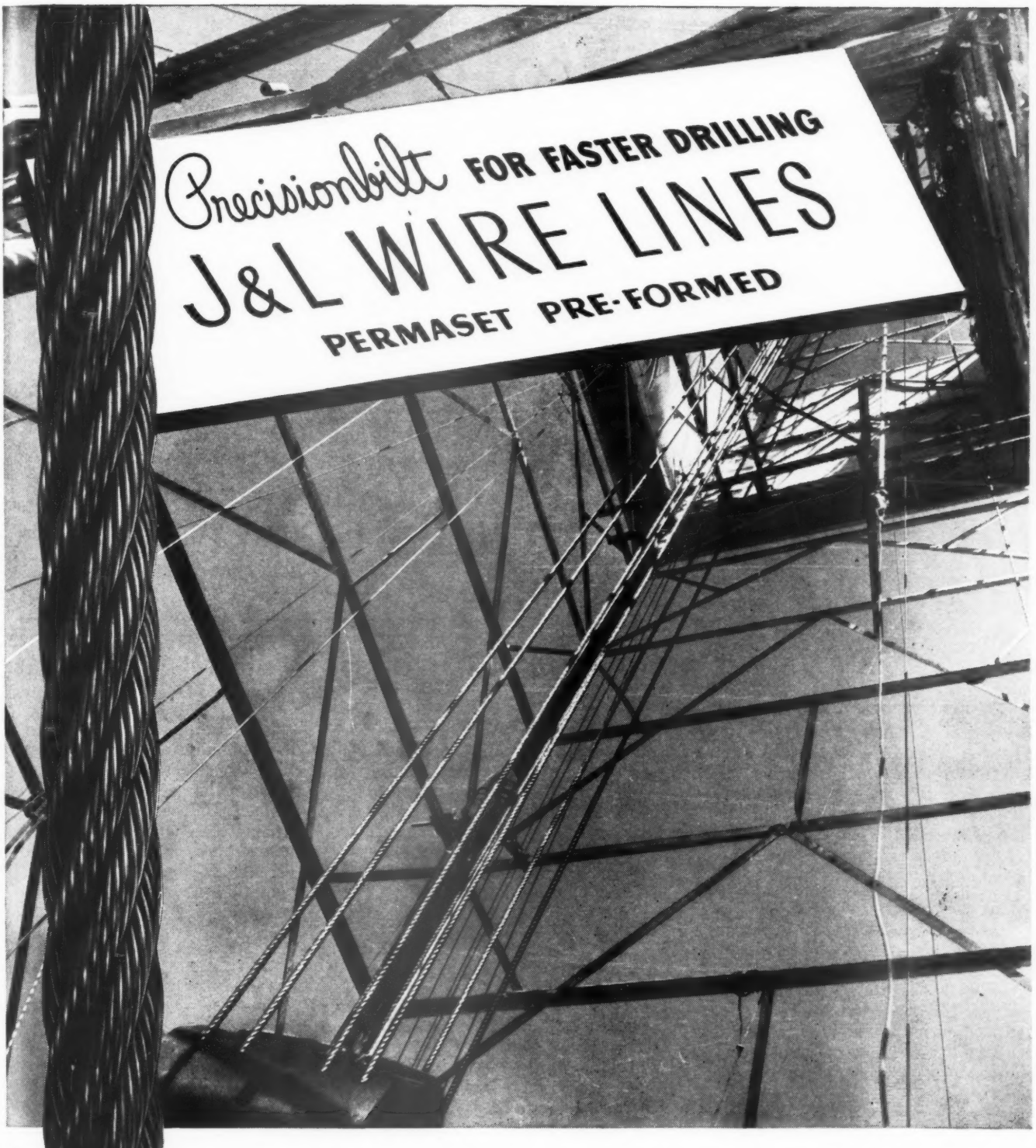

Drilling crews know that they can depend on J&L *Precisionbilt* Wire Rope. They know that it is uniform in diameter, strength, durability and fatigue resistance. The extra life they get from J&L *Precisionbilt* Wire Rope speeds up drilling—lessens the time lost for line replacement. It's economical to specify "J&L *Precisionbilt*" when you buy drilling lines.

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J&L *Precisionbilt* PERMASET PRE-FORMED WIRE ROPE

Petroleum Profiles

J. L. BURKE, President, Stanolind Pipe Line Company

HE can speak Latin and read Greek and is also an authority on transportation law. His accomplishments are varied and multitudinous and not the least of these is the fact that he is the new president of the Stanolind Pipe Line Company with headquarters in Tulsa, Oklahoma.

J. L. Burke—a stocky, square-jawed six-footer — started his professional career by sprinting through wintry nights in Springfield, Missouri, as a call boy for the Frisco railroad. He has been moved up the industrial ladder from the very day that he received his first pay check for vacation and night work.

Conception College in the Missouri town of the same name gave him his first phase of his college education and his classical information is a constant amazement to new acquaintances. By the time he had received his bachelor's degree he had mastered three languages and had also been promoted in the Frisco organization to assistant freight car distributor.

In 1920 came the opportunity to move into the traffic department of the industry that blanketed the Southwest and he moved into the oil business via the traffic department of Sinclair Oil and Gas Company.

In the meantime, even though his intense work at Sinclair would have seemed enough to the average, Burke was attending the School of Law of The University of Tulsa, and in 1929 he received his LL.B. degree. Since that time, he has not only taught transportation law at night in The University of Tulsa downtown college but has furthered his own knowledge by additional research and education until he is considered a regional authority in the field of transportation law.

At Stanolind these days his friends call him "Judge" which has an uncertain origin somewhere deep inside his law degree and knowledge. He is an active hunter and friends each fall receive large presents of deer, elk, antelope, and pheasant that the hustling Burke has shot on another of his hunting trips into the Big Horn country and the Dakotas.

Also an inveterate fisherman, Burke's angling regalia is reputed to pile up quite a freight bill each year. It is his only regular hobby in addition to hunting and even though no large stuffed fish adorn the walls of his office, he manages to iron out a wrinkle or two from his forehead each time he heads for the swift waters where the trout snap eagerly at the fly.

In 1945 Burke was made a member of the Stanolind Pipe Line Company's Board of Directors and was made vice president in charge of traffic less than a year later. He was made vice president in 1947 and early in 1948 he was promoted to executive vice president and six months later became president of Stanolind Pipe Line Company upon the promotion of Bruce Clardy.

Irish wit, friendly eyes, and hair that yearly turns a stronger shade of steel gray is a vital part of this man who heads the largest pipe line system in the world. More than one-eighth of the barrel miles transported by all pipe lines reporting to the Interstate Commerce Commission move under his direction. This includes over 7500 miles of trunk lines and 2700 miles of gathering lines.

In the fall, he relaxes a few Saturday afternoons by being a regular and shouting follower of the Golden Hurricane football team of The University of Tulsa where he earned his law degree. Usually his wife Rhea, son, John, 22, and daughter, Patricia, are with him.

He has proved in little less than half a century that will . . . and industry . . . and application count. He's made the stride from call-boy on the railroad to president of the Stanolind Pipe Line Company with judicious use of these qualities. * * *

PETROLEUM PRODUCTION—A PRICELESS HERITAGE

ALTHOUGH geologists and geophysicists can estimate the potential value of prospective petroleum producing structures, and engineers can estimate the probate ultimate recovery from proved producing fields, the bankers can calculate the "present worth" of producing properties, none can really express the *true value* of today's tremendous exploration, drilling, and producing facilities throughout the world—to the inhabitants thereof.

Those who are privileged to turn on the gas or "step on the gas" seldom stop to realize how much travail has gone into the discovery, development, and exploitation of this priceless heritage—the facilities for finding, drilling, and producing more and more petroleum—to satisfy the ever-increasing demand for a more comfortable way of life.

The availability of huge quantities of oil and natural gas in certain limited areas of the world today is not just a matter of chance. It is true that chances have been taken, that tremendous sums of money have been expended, and that increasingly greater amounts are being spent each year to improve and enlarge the petroleum producing facilities of the world. The important thing about this gigantic effort, however, is not its size nor the chances taken so much as the free, independent, and scientific way the search is being conducted.

Without this cloak of freedom, free enterprise, and competition, the petroleum production we enjoy today would never have been developed. It is not something that could have been planned and executed by any single agency in the world. It is a magnificent accomplishment that is due solely to the untiring efforts of thousands of individuals and hundreds of companies.

Each of these individuals has been trying to find, drill, and produce more oil—at a lower cost—than his competitors by constantly improving older methods and equipment and trying new methods and equipment. Failures have often lighted the way for important advances in the art and science involved in geological, geophysical, drilling, and producing practices. The pioneers have shown us the way.

It is never too late to honor the pioneers—those who have given us the ideas and those who have labored to build our mighty petroleum producing facilities. It is up to the present and future generations to carry on—to expand these facilities—to make more petroleum available to the peoples of the world—at a lower price—just as the industry has done since oil was sold by the bottle.

Let us not take for granted our present high standards of service and efficiency. Let each of us remember that our magnificent accomplishments in finding, drilling, and producing petroleum are the result of competition and toil —*24 hours a day* every day since Drake's well opened the door of progress to a better world. Each of us should do his best to protect the cloak of freedom that will enable us to leave our children an even greater petroleum producing industry. Everything we can do as individuals to maintain this healthy atmosphere of free enterprise will rebound to the benefit of mankind everywhere.

Free and widespread dissemination of data about new and improved operating methods, practices, and equipment is an important factor in the progress of the exploration, drilling, and producing branches of the petroleum industry. It is through the use of this freedom to tell about technical advancements that *The Petroleum Engineer* has served the industry, and it is through the continued use of this freedom that *The Petroleum Engineer* desires to continue in the gigantic task ahead—that is—maintaining a sufficient available supply of petroleum to meet the increasing demand.

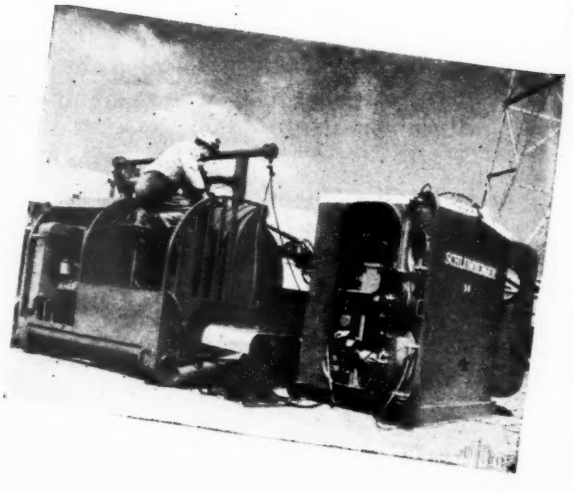
K Marshall Fagin

A Copy of This Picture, Suitable for Framing, Will Be Sent on Request

Here is rugged, mountainous, Colombia. More emphatically than words, this unusual photograph tells the story of how oil men have blazed a trail through its jungles in search of oil.

The job isn't easy for Schlumberger either, but *wherever the drill goes, Schlumberger goes.* In Colombia this tradition is maintained by seven centers equipped with conventional service units and special wildcat units as pictured at right.

Robert Yarnall Richie



SCHLUMBERGER OF LATIN AMERICA, S. A.

Apartado Aereo 4730, Bogota, Colombia

Atlantic No. 3 on fire. Looking east from a plane at 7:30 a.m. September 7, about 13 hr after fire started. In left foreground is a mud pit for west relief well, whose derrick and rig can scarcely be distinguished from the smoke of the oil and gas fire. At right is the south relief well derrick with much steam coming from the rig. Water injection through west relief well killed the blaze 59 hr after fire started.
Photo by Harry Befus.

Canada, 1948

By FLOYD K. BEACH*

EXCLUSIVE

ALBERTA and Saskatchewan together yielded 95 per cent of Canadian oil production in 1947. Production has increased sharply during 1948 due to expansion in the Leduc and Lloydminster fields, while stripper production in Ontario and New Brunswick has not been increased materially by current development.

Total Canadian crude production in 1947 was 7,729,000 bbl while figures prepared by the Dominion Bureau of Statistics show that consumption of petroleum fuels ranging from gasoline to heavy fuel oil was 79,526,000 bbl. Hence on a volume basis Canada produced less than 10 per cent of her needs; on a refined basis her production was even smaller.

These figures suggest that it would be desirable to step up production to ten times the 1947 figure, but a brief study of the map of Canada and its transportation problems shows that any attempt to produce so much oil would bring about serious difficulties unless much of the new production were closer to the concentration of demand in the industrial east.

United States oil production is now barely sufficient for her own needs. Her position for years has been marked by having a surplus of oil for export but the time has arrived when her exports only balance her imports, and very shortly the imports will exceed her exports. Last winter such a shortage of burning oil for domestic consumption developed that there was a popular demand for action that would keep American oil at home.

Under these conditions it is problematic how long the pipe line to Sarnia can be served from United States fields or how long lake tankers, filled from other pipe lines will be supplying refineries beside Lake Ontario with United States oil. Halifax receives crude from ocean tankers that pick up supplies in South America, and a pipe line from Portland, Maine, to Montreal shortens tanker mileage from South America. Vancouver similarly is supplied by tanker from supplies on the Pacific Coast. The flow of oil to Lake Ontario refineries might come more economically by rail from the Montreal terminal of the Portland pipe line than overland from Alberta fields.

These geographical limitations therefore point to consideration of supply and demand within the prairie provinces, and even within that area it must be remembered that Winnipeg is much closer to Great Lakes shipping than it is to Leduc.

In 1947 the prairie provinces consumed petroleum fuels to the extent of 16,243,000 bbl, up nearly 15 per cent from 1946. Since this includes heavy fuel oil, the equivalent crude was probably not so much greater but might have been as great as 18 million bbl or say 50,000 bbl daily. Figures for only the first four months of 1948 are available but there is an apparent increase in prairie demand of 8 per cent over a similar period in 1947 and partial figures for 6 months suggest that the increase may be as great as 11 per cent. This points to a probable de-

*Engineer, Petroleum and Natural Gas Conservation Board, Calgary, Alberta.

Canadian oil production—quantities in barrels.

Field	1947	First half 1947	First half 1948
Turner Valley	5,449,575	2,813,533	2,551,359
Leduc	372,427	34,699	1,283,467
Conrad	202,929	101,469	92,885
Taber	205,236	95,817	103,743
Princess	106,920	26,480	88,481
Wainwright	18,325	8,991	7,679
Vermilion	138,401	73,937	58,471
Lloydminster	304,236	77,376	273,731
Miscellaneous	11,235	3,151	10,181
Alberta total	6,809,284	3,235,453	4,469,997
Saskatchewan	540,117	166,497	374,449
Northwest Territories	231,844	118,429	200,000*
Ontario	130,135	56,099	80,000*
New Brunswick	23,128	12,144	10,000*
Total Canada	7,734,508	3,588,622	5,134,448*

*Estimated.

Figures for Alberta were compiled by The Petroleum and Natural Gas Conservation Board; for Saskatchewan by the Department of Natural Resources and Industrial Development and by C. O. Nickle Publications; remainder by Dominion Bureau of Statistics.

mand for more than 55,000 bbl daily in 1948.

During 1947 Alberta produced 6,809,000 bbl and Saskatchewan 535,000 bbl, a total of 7,344,000 bbl or about 20,000 bbl daily, but by August this had been stepped up to about 40,000 bbl daily, or within about 15,000 bbl daily of the demand. August figures included oil from the wild Atlantic No. 3 at Leduc. Its control and subsequent adjustments probably will reduce the yield of the field by 5000 bbl daily. New wells to be expected during 1948 may add 11,000 or 12,000 bbl daily, or a net increase by the end of the year of 6000 or 7000 bbl daily, bringing the probable supply up to 46,000 or 47,000 bbl daily if other fields continue steady. Early in 1949 there is prospect for saturation of the prairie demand.

Freight on oil from Leduc to Regina runs nearly $1 a barrel and studies are being made of the economics of a pipe line between these points. Imperial Oil has announced such a projected line, but it is presumed that the pipe supply situation has been such as to delay actual construction.

With such a pipe line actually built, a natural outlet for any surplus oil might be into the prairie states. Without the pipe line, rail movements toward Spokane might also be expected. In general, it would appear that Alberta could extend its markets southward and by easing the western interior United States supply problem, facilitate continued supply of eastern Canada from the United States.

Leduc. In our 1947 report* we gave a review of the Leduc field as then known. At this writing, some 112 producing wells have been completed and put on production. New locations are being made at the rate of about 20 per month. Drilling time from spudding to final depth has been cut as low as 21 days for a D-2 well and 26 days for a D-3 well, but the average time is closer to 45 days. To this we must add time for moving in, setting production casing, standing cemented, drilling out and running tubing, so that rig time for the average completion probably runs to 55 days.

Production rate. Pending more extended observation of decline in reservoir pressure and related features accompanying production of oil, and after consultation with operators affected, the Petroleum and Natural Gas Conservation Board set allowables at 150 bbl daily for D-3 wells and 100 bbl daily for D-2 wells. Brief flow tests wide open had suggested that these rates are on the average only a small fraction of what most wells can make, but by limiting the production it is hoped that a large part of the reservoir content may be recovered.

Wild well. Then a wild well upset conservation plans. This report cannot review the whole story of Atlantic No. 3 in the space available, nor is the story fully finished as we write, but the highlights are as follows:

On March 8 the well was drilling at 5331 ft in the D-3 zone and it was intended to set a production string shortly, the idea being to get the shoe below the gas/oil interface, when cavernous lime took the drilling fluid so rapidly that gas began to flow from the annulus. There was a surface string of 10¾-in. pipe cemented at 296 ft but the blowout preventer failed to center and gas blew for a day and a half, bringing oil with it and spreading oil for a long distance from the hole. This blow was stopped, but presently gas made its way to the surface through fissures in the ground. Fissures extended for perhaps 2000 ft from the hole in a northwest direction and eventually oil followed the gas to the surface.

Heroic efforts were made to kill the well through the drill pipe that remained in the hole. Shot after shot of cement slurry followed mud mixed with oats, wood pulp, hulls, feathers, and other solids, and on April 7 one tremendous run of cement, alternated with quick-setting calcium sulphate, put over 10,600 sacks into the formation in a single continuous run without seeming to affect the situation.

When oil appeared at the surface, dykes were thrown up to prevent the oil running off to the river. On May 13 it became necessary to shut down all other wells in the field in order to pump accumulated oil into the pipe line leading to railhead at Nisku.

The following day, May 14, The Petroleum and Natural Gas Conservation Board took over the well and arranged with Imperial Oil, Limited for the release of their operations manager, V. J. Moroney, so that his services might be available to the Board until such time as the well was brought under control.

As of May 14, all oil marketed from the wild well was sold on behalf of, and the proceeds payable to, the Board, subject to their obligation to account for the net proceeds thereof to the persons entitled thereto.

One of the first precautions taken was the closing of a stated area against entry by any person who had not received authority to enter, and then permitted persons might enter only after most thorough precaution against fire. The sight of oil erupting from craters was a temptation to sightseers and when they were turned back on the ground, some used planes to get photos, and it became necessary to pro-

Craters around Atlantic No. 3, shortly after oil began reaching surface.
Petroleum and Natural Gas Conservation Board Photo.

The Petroleum Engineer, October, 1947, pages 68-80.

hibit air traffic over the hazardous area for fear of fire catching in the gas. Owing to rigid policing and a wonderful run of luck in absence of lightning and other sources of a spark, fire was avoided for almost six months from the first blowout.

On June 5 the oil in pits had been lowered sufficiently to permit operation of other wells at 80 per cent of quota. Part of the oil from the wild well was returned to the reservoir through Atlantic wells No. 1 and 2. Current pumping from pits plus flow from drill pipe through a separator gave a measure of the rate of flow, which varied from 8000 to 14,000 bbl daily.

The plan for control centered on two relief wells to be started at about 700 ft south and the same distance west of the wild well, and these were started on May 27 and 31. The south well is still incompleted as we write, after difficulties that hinge on directional drilling, including stuck and parted pipe, but casing was set on September 9 at 5231 ft. The west relief well reached the green shale overlying the D-3 producing formation early in August, but overshot the mark and had to be redrilled for 600 or 700 ft. On August 25 this had been done and 7-in. casing was landed near the target and cemented at 5227 ft. On the 31st at a depth of 5340 ft an attempt was made to inject water under high pressure in an effort to cave green shale into the old hole. The water pressure apparently accomplished some caving, for some water was taken. A couple of acid shots helped a little and presently the derrick over the hole showed signs of leaning. Attempts to support it were made, but the ground was becoming unstable and it collapsed about 1:00 a. m. on September 6.

Footage drilled in Alberta for oil and gas.

	1947	1948
January	24,991	67,972
February	25,309	86,425
March	27,284	112,544
April	31,448	113,664
May	78,199	83,570
June	100,830	180,195
July	101,706	
August	109,781	
September	90,802	
October	115,026	
November	90,889	
December	86,193	
Year	882,358	644,370

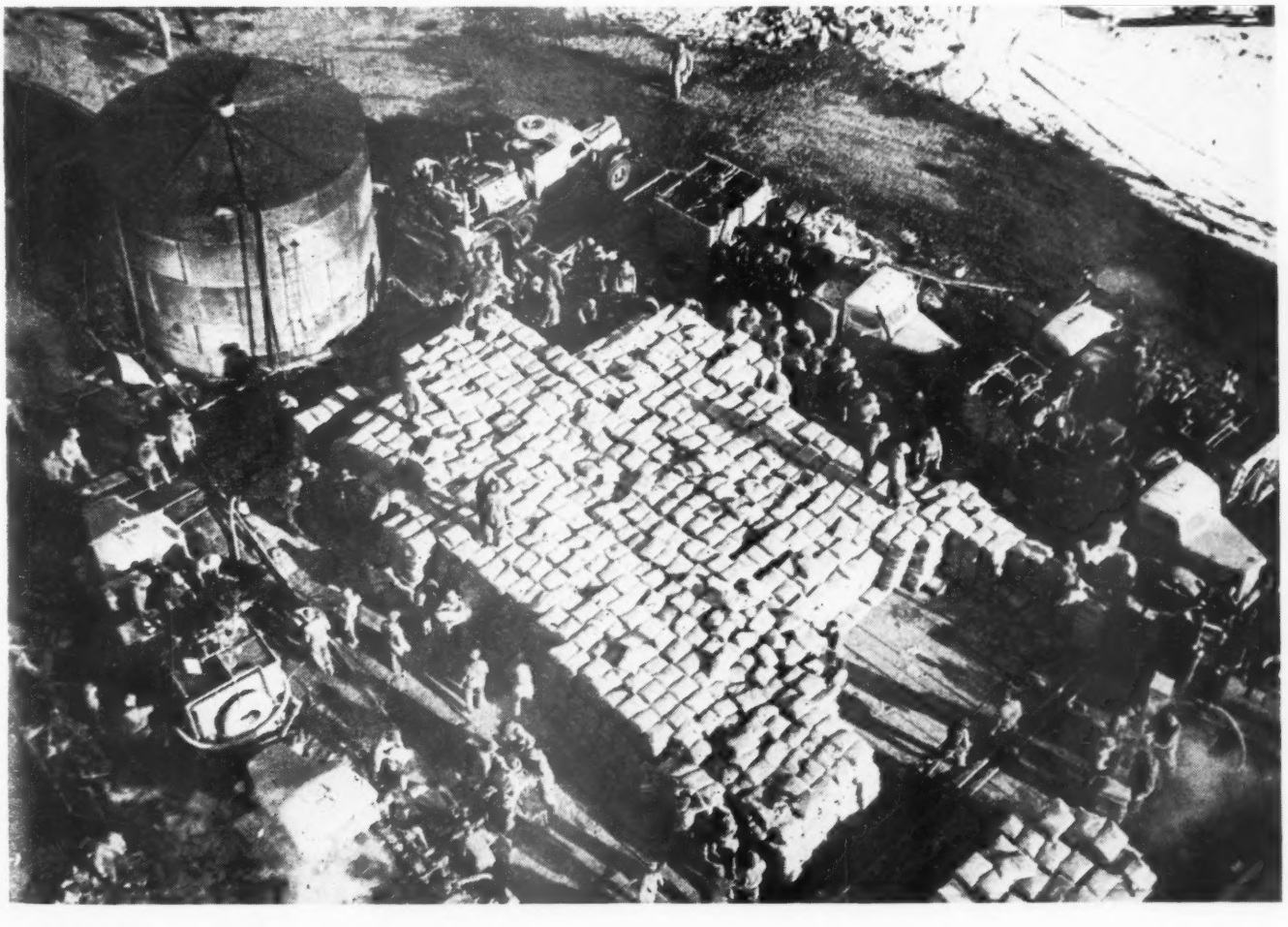
Meantime, on Sunday, September 5, rocks were being thrown from the hole around the wild well, and the rate of water injection into West Relief was too slow. So the hole was deepened 29 ft and this put the bottom into the D-3 zone, though not necessarily into the hole of the wild well. Several acid shots after reaching final depth were used to open the formation, and the last shot obtained a complete breakdown, after which the hole took water at 1200 bbl per hr, a rate dictated more by the ability to supply water than by reservoir conditions.

While still acidizing at 6:18 p. m. on Labor Day, September 6, the well caught fire. Eye witness accounts suggest that the spark was due to a rock striking the collapsed derrick. Fortunately there were no casualties, though there is an account of two men having to do a sprint away from somewhere too near the fire for comfort.

The fire attracted much publicity but policing was adequate, and the remedial work proved the soundness of the plan, for by the afternoon of September 8, the fire started to die, and by 5:30 on Thursday morning, 59 hrs after it caught, workers were able to go to the well head, with practically all the fire out.

During the period prior to May 14,

More than 10,600 sacks of cement and Cal-Seal being run into Atlantic No. 3 on April 7.
Petroleum and Natural Gas Conservation Board Photo.



the Atlantic company marketed 39,231 bbl from the wild well. Since then the Board marketed 945,943 bbl, and there is a sump that did not catch fire, containing an estimated 7000 bbl; 243,200 bbl were returned to the formation through Atlantic Nos. 1 and 2. The well made something over 1,250,000 bbl during its wild career.

One expedient tried in an effort to halt the trouble was injection of water through Imperial No. 48, a quarter of a mile to the west, and during the period May 28 to June 22, 691,000 bbl of water were injected. The net result of this expedient seemed to be merely to delay the decline in reservoir pressure and, if anything, to increase the flow of oil and gas from the wild well, so the experiment was discontinued.

As this is written, water injection into West Relief well continues, and work on South Relief is going on. Until an adequate plug has been placed at the foot of the wild well it cannot be said that the job is finished, but at least a very serious condition has been kept in hand, and Moroney and those who worked under his direction deserve every credit for their efforts. The entire industry conducted itself with a most commendable spirit of cooperation throughout a difficult period of tension.

▸ **Quality of oil.** There is a little variation in gravity dependent, apparently, more on producing conditions and the amount of light fractions stabilized than on which zone or part of the field is involved.

Distillation analyses of two samples of 40.1 and 40.2 API showed initial boiling points of 112 and 110 F, with about 38 per cent in the gasoline range, 22 per cent in the light oil range; 40 per cent heavy.

Oil from the wild well became somewhat weathered and its gravity might have dropped to 32°.

One well has made salt water emulsion. Imperial No. 7, bottomed at 3008 subsea, and only four feet into D-3 started making just enough salt water as an emulsion to give serious refining trouble. It was taken off production after its condition was recognized and some efforts have been made to treat the oil before putting it into the pipe line, but until the general field situation demands serious work on this problem it is likely that this well may stand idle.

▸ **Casinghead gas.** Gas with oil from wells produced in the regular way runs about 475 cu ft to the barrel and in the aggregate for June amounted to less than 3,000,000 cu ft daily. Its specific gravity of about 0.76 suggests sufficient natural gasoline to make a plant economically feasible, and one will probably be built before long. It is our personal guess that the stripped gas will be returned to the reservoir for pressure maintenance.

▸ **Reservoir conditions.** Hume states* that the D-2 zone of partly vuggy porous dolomite is about 150 ft thick. He considers that production comes from about 35 ft of porous beds, that there is no gas cap and the oil is so deficient in gas that its natural flowing life may be short. The original pressure within this zone is reported to be 1770 lb.

Concerning D-3 zone, he states it consists of permeable dolomite, in part very porous, so that commonly there is loss of circulation in drilling. Water level was reached in Imperial No. 2, the discovery well, at about 3020 ft subsea. A gas cap has been found in other wells, with the gas/oil interface at about 2980 subsea, so that the oil zone is 38 or 40 ft thick, with a gas cap in the higher part of the structure more than 100 ft thick. The original reservoir pressure in D-3 was about 1895 lb.

Spacing pattern set by the Conservation Board permits one well to 40 acres for each zone. This has resulted in "twin" wells where both D-2 and D-3 zones are productive. The wells are drilled far enough apart to avoid danger of one hole fouling the other, but both of the twins must be bottomed within the central ten acres.

▸ **Other productive zones.** Over part of the field the Viking sand carries gas. One well has been completed in this zone as fuel gas supply for drilling.

The Blairmore formation (Lower Cretaceous age) overlies the Devonian and Continental No. 3 in 12 of 7, 51-25 W. 4th has recently been completed in this horizon as a producer after finding D-3 either absent or too low. This Blairmore oil is reported to be 37.4 API and in commercial quantity. Imperial No. 80 in 16 of 26, 50-26 W. 4 obtained oil from the Blairmore during drill stem tests, but went on to complete in D-3, and an offset is being drilled as Central Co-op 5C in 13 of 25 to exploit the find.

▸ **Extent of field.** One distinct portion of the field appears to be mostly within Towship 50, Range 26, but Okalta Leduc 2, in 10 of 33, 49-26 obtained oil. Whether it marks a separate pool or an extension is still uncertain. There is a chance that the field limits may extend into Township 50, Range 27.

Aside from this area, Imperial has completed 5 wells near the middle of the next township north, calling them "Woodbend." It is too early to predict trends in Woodbend township. The structure may join up with Leduc or it may be separate. The fact that the oil/water interface is almost exactly at the same elevation as Leduc suggests continuity.

The map (Fig. 1) shows contours on top of D-2, and the known limits of D-3 are indicated. The interval from the top of D-2 to top of D-3 is fairly consistent, but it changes slightly in different parts of the field where D-3 is present and its position known. In and close to Section 9, 50-26, the interval ranges from 250 to 283 ft. Two miles north in Section 21, the interval runs 265 to 295 ft. In Sections 23 and 26 we find intervals of 290 to 393 ft. and then suddenly find the D-3 absent. In Woodbend the interval appears to be 323 to 330 ft in the first three wells drilled.

In general, the consensus appears to be that D-3 is a bioherm or reef that was of local extent, dependent on conditions at the time of deposition, while D-2 was of much wider occurrence. Production in D-2 is limited laterally by porosity but it is now apparent that there is also structure in the sense of doming. Possibly the doming is a secondary feature reflecting the presence or absence of D-3 deposition below.

Reservoir studies are currently being carried on and it seems quite apparent from the relation between pressure decline and oil produced that at least the D-3 zone has a gas-cap and dissolved gas drive. That is what we would expect with bottom water highly concentrated in soluble salts and with no probability of regional continuity in the porous zone. In fact some indications suggest that the D-3 will prove to be one or more isolated islands of dolomite surrounded by impervious shale. We cannot as yet make a definite statement about the drive in the D-2 zone. There is dissolved gas, but since no well developed gas cap has as yet been found this statement is still somewhat speculative. Bottom water is strongly salt, so there is doubt regarding water drive.

Scrutiny of the structure contours on the top of D-2 when considered in connection with a general southwestward dip of the strata shows that the anomaly developed by drilling is not of a very great order, and raises the hope that even moderate seismic anomalies may warrant drilling for test.

▸ **Lloydminster.** The combined output of Alberta and Saskatchewan wells in this area for the first half of 1948 was over 645,000 bbl or 3540 bbl daily as compared with 839,269 bbl or 2300 bbl daily throughout 1947. In July the production was 5321 bbl daily

*Hume, G. S., and Ignatieff, A. "Natural Gas Resources of the Prairie Provinces," Ottawa, 1948.

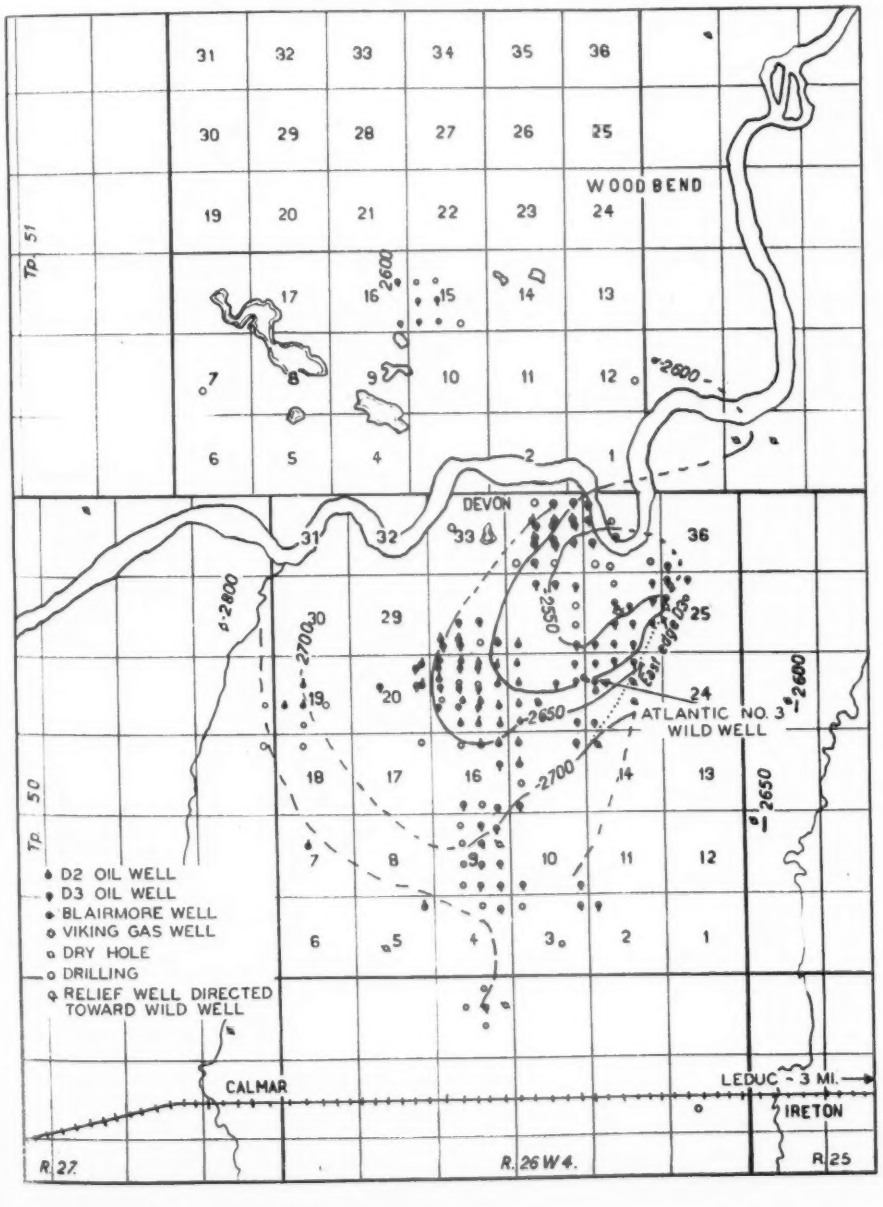
from 165 wells as against 83 wells in July last year yielding 2560 bbl daily. Part of the increase should be credited to improved treating and marketing facilities. The rate of drilling development wells would be stepped up if more casing and tubing were available and with added servicing rigs. Wells are drilled and cased in 4 to 6 days, but a servicing rig may be needed for two or three weeks, to drill out cement, bail until running sand becomes insignificant, and run tubing and pump.

Refining in the sense of runs to stills is very limited, but nearly all oil is delivered to treating plants for removal of sand and emulsion. Excelsior refinery can treat 1200 bbl daily and Husky claims a capacity of 6000 bbl daily, so there is treating capacity to spare. Husky runs part of its oil to stills with asphalt as the objective and diesel and domestic burning oil as by-products. Asphalt demand for highway consumption has taken all the output, and the amount manufactured has in fact been kept to the market for asphalt. Any surplus crude has found a ready market as locomotive fuel. The Flintkote Company is now erecting a plant alongside Husky with the intention of using a part of Husky output for processing specialty asphalts.

The crude is not suitable for turning out white products without elaborate and expensive equipment. If cracking is to be carried out, all the water must be removed in order to bring the salt content to a reasonable figure, while if used as locomotive fuel the cleaning need not be so nearly complete. The crude is not suitable for house heating owing to its high viscosity. In spite of the active demand for house fuel, the people handling the crude are not likely to increase the charge to stills because of the problem of marketing surplus asphalt.

A recent promising discovery was made 14 miles due east of the town of Lloydminster and an equal distance from other oil production. This comes as a result of an energetic exploratory program by Husky. The team Husky and Jupiter located its McLaren No. 1 in S.W. 4 of 6, 50-25 W. 3, drilled to 2211 (8 ft into the Devonian), electrologged and set casing close to bottom. The electrolog showed a favorable kick in the Colony sand (uppermost sand of the Blairmore formation of Lower Cretaceous age) as well as a kick in the basal Blairmore sand. Perforations in the latter sand 1952 to 1959 gave no results, and perforations 1692 to 1697 gave small result, but two feet of sand 1668-1670 brought in 25 bbl daily of 13.6 API oil later increasing with continued bailing to 40 bbl daily. Since this is the first commercial oil from the Colony sand, earlier discoveries being dry gas from that member, the discovery is looked on as important. With only two feet of effective production it is hoped that there may be thickening of the sand in adjacent locations. This sand is close to a disconformity when the Colorado sea transgressed Continental beds and locally the sand may have considerable promise.

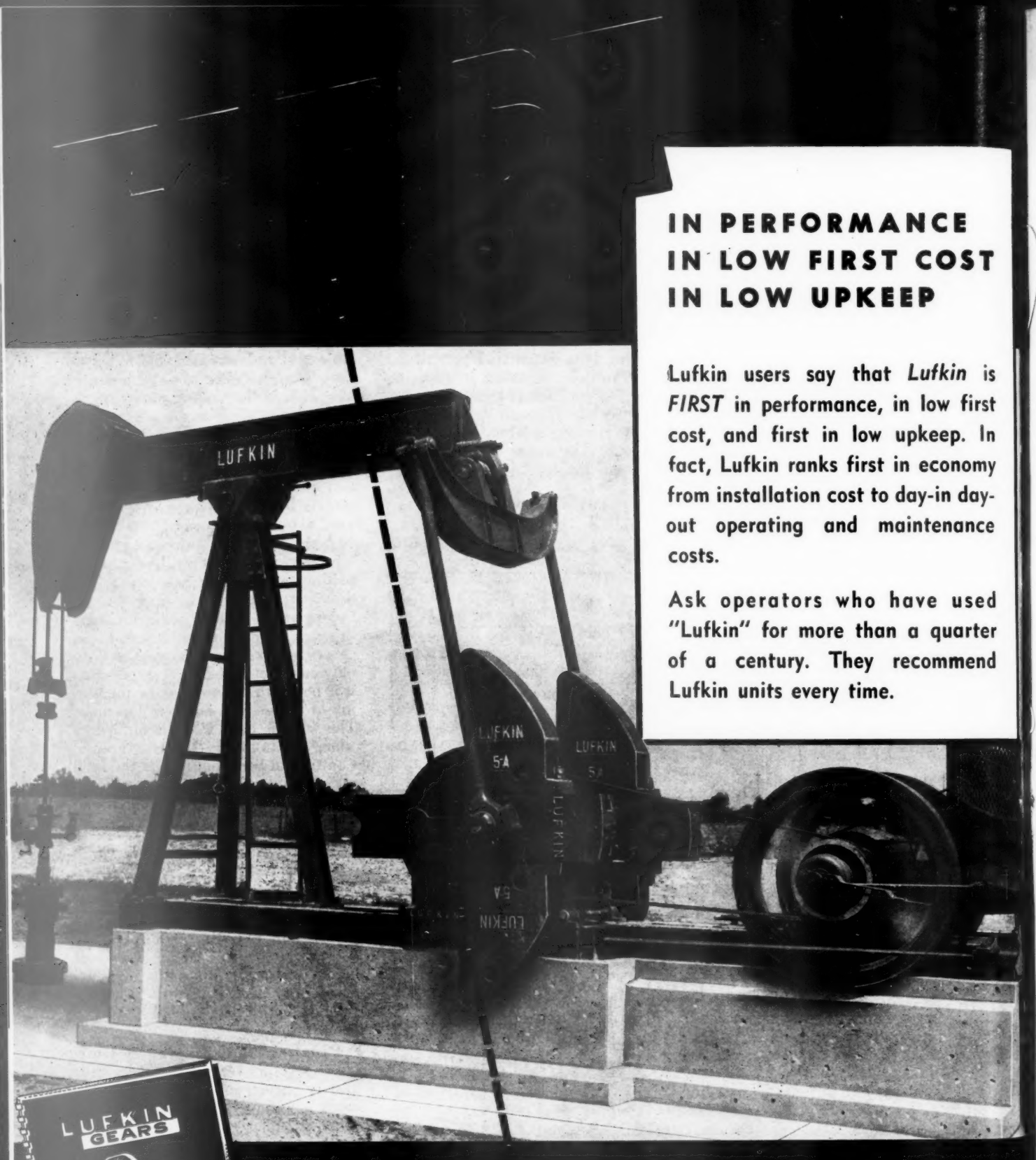
FIG. 1. Structure contour map of Leduc field.



▸ **Bantry.** Some 16 miles south and 4 miles west of the Princess group of wells producing from the Devonian, California Standard and Imperial in a joint test found oil last December in or just on top of the Madison limestone of gravity about 24° and initial production rated at 97 bbl daily through 10/64-in. choke. The well made nearly 60 bbl daily in June. Plans for an offset were made in January but to date the offset has not been started.

▸ **Pincher creek.** Canadian Gulf, after several years of work with gravity meter and seismograph, located a well in 15 of 24, 3-29 W.4, some 20 miles southeast of Pincher Creek and about an equal distance west of Cardston. In the disturbed belt of the foothills, the objective was so deep that unusual geophysical methods were employed, including reversion to refraction shooting.

They found the Madison in the first try at 11,700 ft and very close to predrill estimates. In a test 11,718 to 11,800 ft there was a large flow of gas and 150 ft of condensate. Seven inch casing was set at 11,755 and cemented through successive perforations to give continuous backing to the pipe.



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This precaution seemed advisable after an indication of bottom hole pressure of 5775 psi.

The hole was deepened and a test at 11,927 ft showed a flow of 44,500 Mcf/day plus an estimated 1000 bbl daily of condensate. Much coring was done to a final depth of 12,516 ft, when 5 inch casing was run and cemented close to bottom. Testing by perforations successively higher showed no water at the bottom, but it was not until getting up to the level 12,058 to 12,194 ft that production was brought in at a scale of 2,400,000 cu ft a day and 65 bbl of 53 API condensate. Testing continues.

The well can now be rated a gas and condensate discovery, with hope that a well down the flank may find an analogy to Turner Valley west flank with liquid oil containing dissolved gas.

Gulf in the meantime has started another well about six miles north and four miles west in 1 of 29, 4-29 W. 4.

Other wildcatting. Operation Muskeg, some 70 miles from the railway and highway and in virgin territory, both from an agricultural and an oil standpoint, has gone very slowly. Its pre-drill estimated cost of $1,000,000 has long since been passed. Exceedingly hard siltstone of Triassic age proved a most expensive material to drill. It was recently reported to have reached the Madison at 9634 ft and 7-in. casing has been set at 9654 ft. More rapid progress may now be possible, with some means of assessing its value before long.

One major company after another has entered the Alberta picture since the Leduc discovery. C. O. Nickle, in his August survey, shows 64 geophysical units working in Western Canada, 58 of which are in Alberta, 2 in Saskatchewan and 4 in Manitoba. Of the Alberta totals, 40 are seismograph, 9 gravity meter, 1 magnetometer and 8 structure test rigs. Of wells that are likely to be 1948 completions, licenses issued to August 20 involve 109 locations that are exploratory.

Actually 130 wells finished drilling during the first six months of 1948. Using the AAPG classification there were 110 completions of which 74 were field development and 36 exploratory. Of field development 5 were dry holes; 2 in Turner Valley were known to be risky locations, 1 in Leduc came as a surprise low and 2 in Lloydminster. One Lloydminster development well proved to be a gas well.

Of the exploratory wells 5 outpost wells were successful and 5 dry holes. Two of the successful outposts extended known pools in Lloydminster and one probably marks a new Lloydminster pool. Two Leduc wells may mark new pools or mere extensions. Among 26 new field wildcats we can credit Imperial Woodbend No. 1 with discovery either of a new field or new pool, Gulf Pincher Creek with a gas and condensate discovery and Roxana 4-K with gas discovery.

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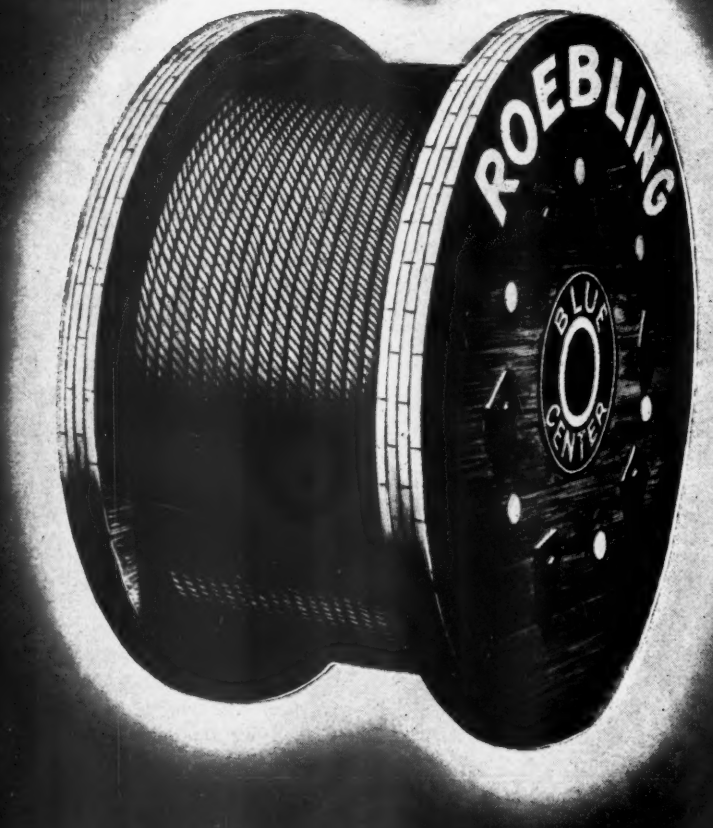

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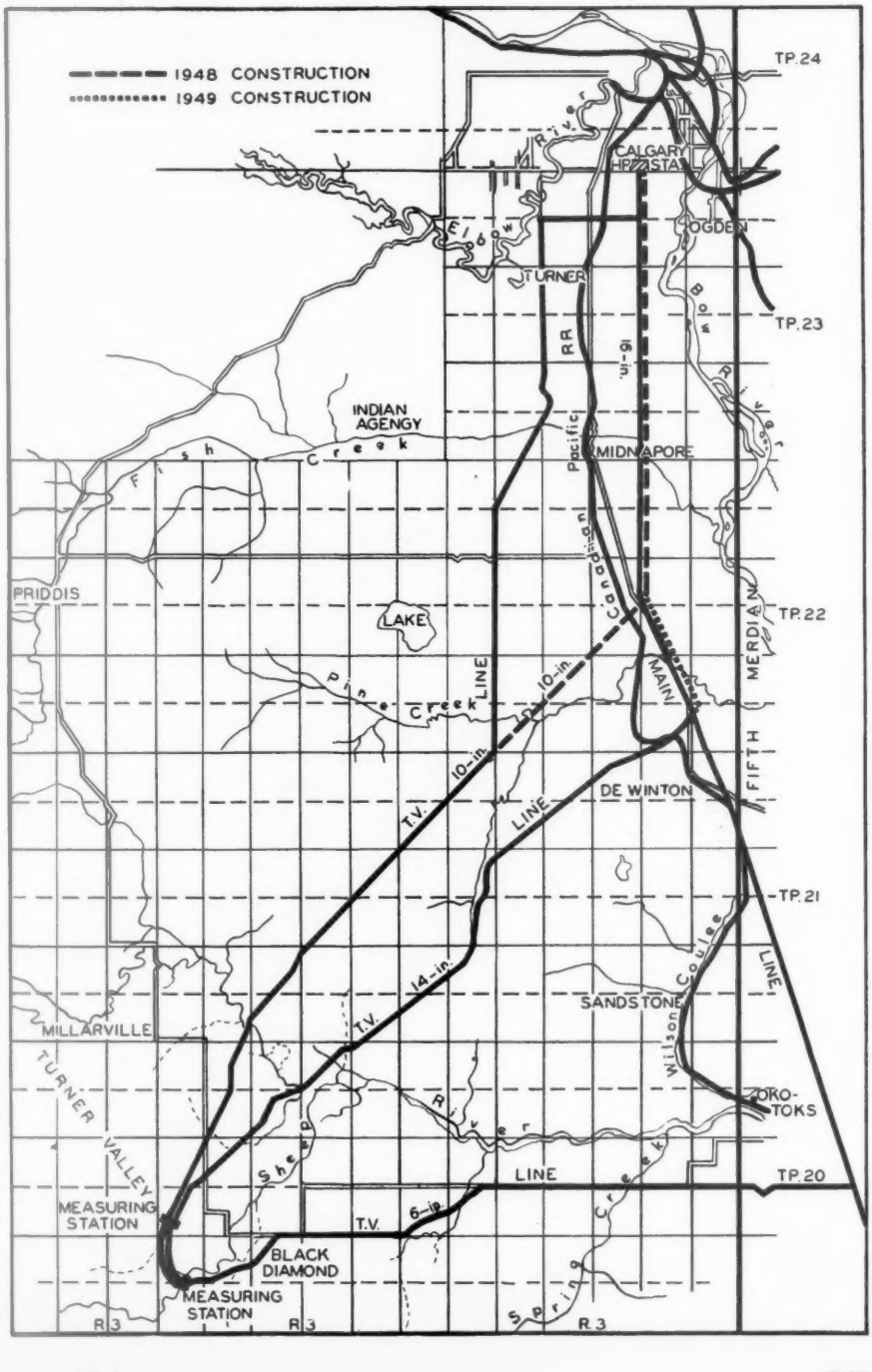
Wildcats in other parts of Canada. Saskatchewan records only 7 wildcats in the first half of 1948. Ontario drilling is largely in search of natural gas. Shell pulled out of Alberta late in 1947 and took up a big area in New Brunswick. After some geological work they have started a well about 6 miles southwest of Sussex as Urney No. 1 and at last reports were drilling below 3000 ft. Some desultory drilling has continued in the Gaspé peninsula of Quebec, but without commercial production established.

Leasing regulations. Alberta issued new leasing regulations in March of this year. The reader will recall that oil and gas rights in Alberta are held by the Crown in the right of the Provincial Government except for the area contained in land grants to the Hudson's Bay Company, to railways, and a few early homesteads. The Province, therefore, has the bulk of oil rights, which it usually leases at $1 per acre yearly plus a royalty on oil and gas produced. For the purpose of exploration, reservations may be taken at reduced rates for a limited time. One person is now limited to two reservations held at one time, not exceeding 100,000 acres to each reservation. After examination of a reservation, he may lease up to half of the reservation, checkerboarded, and an equal portion becomes Crown Reserve, to be disposed of at the option of the Province. Reduced rental is provided for areas proved up as gas fields that are producing gas, and still lower rental for gas fields that are not yet producing.

Earlier regulations respecting Crown Reserves did not provide for checkerboarding, so Imperial was able to lease a solid block in the Woodbend township, and several parcels of Crown Reserve adjoining the lease have recently been disposed of by tender with prices going as high as $497 per acre.

The new regulations do away with credits for rental arising from exploratory drilling expenditure, but they provide that certain expenditures in examination of reservations may be used in lieu of the first year's lease rental.

FIG. 2. New and proposed pipe lines.



Oil pipe line. Leduc field is still dependent on railway tank car shipment from the Nisku terminal of the field collecting system. A proposed pipe line extension from Nisku to the Edmonton refinery has been waiting for pipe just received. The line may be complete by the time this appears in print. Studies are being made of a pipe line from Leduc to Regina, but in the present state of pipe supply it is understood that this project must wait for an easing in the pipe supply situation.

Natural gas pipe line extensions. Canadian Western Natural Gas Company, serving Calgary, Lethbridge and intermediate points has a program to serve 2100 new customers this year and hopes to accomplish it if materials are available.

To meet increasing loads, the 16-in. main laid in 1912 from Bow Island to Calgary is being looped this year by 8 miles of 16-in. 65-lb English pipe (Stewart and Lloyds) between De-Winton, where a 14-in. line from Turner Valley enters the 16-in. line, and Calgary. It was intended to extend the loop an additional three miles, but the pipe could not be obtained. Another extension of 4½ miles of 10-in. line will be laid when pipe is received, as a cross connection between the 10-in. Turner Valley to Calgary line and the 16-in. loop. (See Fig. 2.)

During the spring floods this year trouble developed at the Oldman River crossing, where two 10-in. lines take gas across the river. One of these lines had a leak at a welded joint and the other line shifted. For about a month it was necessary to meet Lethbridge demand by stored gas from Bow Island field. Temporary repair was

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. . . 3 *The drill collar's hard heat-treated surface that reduces gripping efficiency.*

and 4 *The relatively low drill string weight available for wedging the slips into the bowl.*

That's why safety-minded operators throughout the world have adopted Baash-Ross Drill Collar Slips as "must have" rig equipment, because these Slips are *specially designed* to overcome the risks of supporting a drill string in the rotary table. In contrast to the normal fixed-curvature design of rotary slips, the unique multi-segment design of Baash-Ross Drill Collar Slips permits them to w-r-a-p around the drill collar like a chain tong. They take a full slip-proof grip whether the drill collar is new or worn, round or out-of-round. *And they automatically compensate for as much as 1½" change in drill collar diameter — more than ample for modern drilling operations.*

For example, note in the table how a Baash-Ross Drill Collar Slip that fits a 7" diameter drill collar will also fit *any* diameter down to 5½". Adjustment for wear is automatic and continuous throughout the working range!

This means that Baash-Ross Drill Collar Slips automatically take a *full* grip on any drill collar within their range—a grip that gives adequate support to compensate for the continuous wear which changes drill collar diameters . . . for the hard heat-treated surface . . . and for the lack of drill string weight.

Sizes and Operating Ranges of Baash-Ross Drill Collar Slips

SIZE*	Operating Range	
	From	To
A	3"	4½"
B	3¾"	5¼"
C	4¼"	5¾"
D	5½"	7"
E	6¾"	8¼"

*(all sizes available in both "Regular" and "Long" types)

TWO TYPES

Baash-Ross Drill Collar Slips are available in two types —"Regular" and "Long." The "Long" type has extensions above the gripping area to provide a seat for the Baash-Ross Safety Clamp — the clamp that puts a non-slip, *yet removable,* "stop shoulder" on *any* drill collar to compensate for the hazards of flush design when supporting the collar in the table. For complete details see your nearest Baash-Ross representative — or write direct!

The "Why" of Baash-Ross Drill Collar Slips

ORDINARY SLIPS that fit the drill collar when new (A) are unable to adjust themselves to smaller diameters as the drill collar wears away. Result, grip becomes less and less adequate (B) and risk of a costly fishing job constantly greater.

BAASH-ROSS DRILL COLLAR SLIPS consist of many narrow slip segments flexibly linked together. Result —they w-r-a-p around the drill collar and always take the same *full* grip whether drill collar is new or worn, round or out-of-round.

LINERS ARE EASILY RENEWED

To insure long life, minimum maintenance and maximum gripping efficiency at all times, the liners in Baash-Ross Drill Collar Slips can be readily renewed by simply pulling a stainless steel pin, sliding out the worn liner, inserting a new liner and replacing the pin. *It's simple, quick and inexpensive!*

made by inserting a 6-in. line through the 10-in. in which the trouble was confined to a welded joint. Proper replacement of the defective lines will be made when materials are available, but propably not until this fall.

To meet increasing demand, Northwestern Utilities has drilled three new wells this year and is laying 7.5 miles of 16-in. main line extension in the field plus enough 4-in. and 6-in. gathering line to connect up new wells. Looping on the main line to Edmonton continues and this year includes 21.8 miles of 16-in. main. When this program is finished there will be three mains from the field to Edmonton and a failure in any one of them will not interrupt service.

▸ **Board publications.** The Petroleum and Natural Gas Conservation Board has wide powers in regulating developement of oil and gas. Every well drilled deeper than 500 ft in Alberta must have a license which is issued by the Board. Daily drilling reports are filed with the Board, and drill cutting samples (if required) and electrologs are supplied to the Board. Subsurface information respecting wells not within an "administrative area" is kept confidential for a year. From the data available, the Board published a "Schedule of Wells Drilled (in Alberta) for Oil and Gas to 1947," which lists each well, by whom drilled, when, where, how deep, casing, occurrences of water, gas and oil, and a brief of geological markers. The Board issues weekly reports of drilling operations and an estimate of current oil production, monthly reports giving final production figures, value of oil produced and related information. Annually a book is prepared giving a resumé of much of the material in monthly reports. Quite a number of maps bearing well locations are available, as well as type well logs of various fields and a geological correlation chart. List with prices can be obtained on request.

▸ **Saskatchewan publications.** The Department of Natural Resources and Industrial Development at Regina, Saskatchewan, puts out a monthly summary of development and production, and has issued some other related publications.

▸ **Lease maps.** Nickle Map Services in Calgary issues Alberta Lease Maps, revised monthly, and the service is sought by active oil companies.

▸ **Oil publications.** C. O. Nickle publishes a daily bulletin, mimeographed. He is a very accurate and complete reporter, and acts as oil reporter for a number of daily papers.

Western Examiner, published weekly in Calgary, is also widely read.

▸ **Western Canada Petroleum Association.** This organization was formerly Alberta Petroleum Association, but its scope was broadened to include Saskatchewan and Manitoba. Fred M. Graham is president, and E. W. Kolb, secretary, with offices in the Lancaster Building, Calgary. It is concerned with watching legislation, priority arrangements for oilfield equipment, labor relations and many related problems of the industry and its membership includes most active companies engaged in development, exploration, refining, etc.

▸ **Natural gas.** Alberta's supply of natural gas is a boon to those of its residents that are on distribution lines, and others are anxious to obtain supplies from Alberta fields. A company has been organized for the purpose of piping gas to Winnipeg and intermediate points and has gone so far as to obtain Dominion authority for its operations. Between such authority and actual achievement of its desires lie the hurdles of pipe supply and permission from the Alberta Government for export. Other interests have mooted a pipe line from Alberta via Spokane, Portland and Seattle to Vancouver, and the same hurdles intervene.

Dr. G. S. Hume, Chief of the Geological Survey of Canada, has taken an active part in trying to extend the use of Alberta natural gas, and in collaboration with Mr. A. Ignatieff, engineer with Bureau of Mines (Canada), prepared a report on Natural Gas Resources of the Prairie Provinces, which was issued in April as a mimeographed volume of 244 pages plus some 38 or more blueprint maps. The report is particularly valuable because the authors have given all the basic data for each field that was used in their calculations. Sometimes some essential data were missing and assumptions had to be made. The authors have stated what the assumptions were so that any person may in future substitute known values for assumed values and go on to arrive at a fair valuation of the particular field that is being studied.

He divides the reserves into:

Proved reserves	1,433 billion cu ft
Probable reserves (Alberta)	2,185
Probable reserves (Sask.)	65
Total	3,683 billion cu ft

plus potential reserves in some 21 Alberta localities and two to the east.

His proven reserves were computed by material balance methods to an exhaustion pressure of 100 psi absolute and his probable reserves are based on porosity-area method.

Most fields will be giving much operation trouble long before a mean reservoir pressure of 100 psia has been approached, so the proven reserves figure may be a maximum. We gather from perusal of the portion of the report dealing with probable reserves that he has extended his calculations to all the area that each field could hope to develop from any present indications, and hence the probable reserves may also be a maximum figure. There is sound reason, however, for a hope that possible or potential reserves may be great enough to permit use of the figures he deduces as "proven and probable" for purposes of arriving at engineering studies of development problems.

During a meeting at Jasper, Alberta, September 2 to 4, of representatives of most Canadian provinces as well as representatives of the Dominion Government, Alberta gas export policy was stated by Hon. N. E. Tanner, Minister of Lands and Mines for Alberta. Tanner favors the export of a part of its natural gas reserves, provided reserves are adequate for projected domestic and industrial needs in the province, and a surplus is available. A committee is to be set up by the province to study Alberta reserves and economics.

Before numerous interested parties assume that this means ease in acquiring permission to export gas and before they spend time and money in following it up, they should consider a statement by W. J. Dick, M.E.I.C., for years interested in Alberta fuel problems. At a meeting of the Engineering Institute of Canada held in Banff in June. Dr. Hume gave a paper on oil and gas in Canada and reviewed the report above mentioned. In discussion, Dick stated*

"There are two natural gas pipeline proposals now being actively mooted for exporting gas from Alberta. These together would require about 200 per cent more gas than is now consumed in Alberta. If you add to this our normal increase and the gas required for only one 10,000 bbl per day synthetic oil plant, Alberta's actual and probable reserves would only be sufficient for some fifteen years. In this connection it is of interest to note that the gas consumption in Edmonton has doubled in the last seven years."

▸ **Tar sand development.** Dr. K. A. Clark of the Alberta Research Council in an article in Western Miner (Vancouver), for August, 1948 states that a pilot plant at Bitumount, having a designed capacity of 350 bbl daily, should be in operation shortly. This is not a large enough plant to have commercial possibilities, he states, but is amply large for pilot plant purposes, including the determination of costs.

*The Engineering Journal, August, 1948, p. 429.

★ ★ ★

Paraguay Diary

By C. S. PERKINS

I LEFT Los Angeles at 10:45 p.m., Saturday, January 31, 1948, on Pan American Air Lines, and arrived in Mexico City at 9:00 o'clock Sunday morning, where I was met by my friend, Charley Schneider, recently retired by the Tide Water Associated Oil Company in San Francisco. Charley took me for a tour of the city, and I spent a very enjoyable evening with him and his son-in-law — the Minister of Hydraulics in the Mexican Cabinet.

EXCLUSIVE

I left Mexico City on Monday morning, and had a rough flight to San Jose, Costa Rica, with stops at Tapachula, Mexico; Guatemala, San Salvador, and Monagua, arriving at about 2:30 in the afternoon. I was met at the airport by S. J. Meares and Harry Dykes. After registering at the hotel, we took a trip out to the marketing station that was recently completed. I was very much surprised at the construction of the marketing station. It is much more modern than I had expected to see. The next day, I was driven down to Puntarenas by Steve Meares, and visited the new marine terminal, which was practically completed. I was very much impressed with the location of the station, as well as its construction. One thing quite noticeable was the lack of excess material that is usually to be found lying around after a job is completed.

This plant is well situated out on the peninsula with an estuary on one side for servicing small boats, barges, etc., and the bay on the other side, with submarine lines for receiving cargo and refueling large vessels. The only thing that is required now is products, and, due to the political unrest, the first shipment is being delayed. The political situation in Costa Rica seemed to be very tense as it was just a few days before election, and everyone seemed to be on their guard. We were stopped four times by the Military, and our car was searched for concealed weapons.

The main industry in Costa Rica is agriculture—coffee and bananas are the chief products, with sugar cane, pineapple, cotton, and cattle raising contributing to the country's income. One of the notable peculiarities about Costa Rica is the lack of modern transportation — practically all hauling is done with ox carts, as roads have not been developed for motor truck use. The country is beautiful, the climate ideal.

I left Costa Rica on Wednesday afternoon, arriving in Balboa that evening, and was met at the airport by our division manager, Harry Painter. I reported at the hotel, and then we took a trip through our plant, and a drive through Panama City, which was very interesting. The next morning, Harry drove me across the Peninsula to Colón, and after lunch, returned to Balboa—a transcontinental round trip in few hours.

Bob Worsley, our district manager, then took me to various points on the Panama Canal, and through the government warehouses in the Canal Zone. The stocks in these warehouses are available to the company for use in our Balboa operations, but cannot be used outside the Canal Zone. I also had the opportunity of meeting Lewis Summers, the owner of the Isthmian Construction Company. Summers had purchased many excess construction units from the government, and these were reviewed with the idea in mind of purchasing for other operations in South America. The asking prices, however, are considerably above the same class of material in the States.

I left Balboa Friday afternoon about 2:30 for Buenos Aires. After we were out for about an hour and a half, one motor failed to work properly, and we returned to Balboa for repairs, which caused a delay of approximately four hours, and we did not arrive in Buenos Aires until about 7 o'clock Saturday night, February 7. Stops en route were made at Guayaquil, Ecuador, Lima, Antofagasta, and Santiago. Mr. Navarette, our representative in Santiago, was at the airport, and we had a nice chat for about 30 minutes while the plane was refueling.

In Buenos Aires, I was met by Gordon Livingston, from our Asuncion office, and a representative of the Chadwick Weir Company. At the hotel, we were joined by Jack Lewis, Drilling and Exploration Company, and we discussed at great length our transshipment problems at Buenos Aires. The docks at this point are very congested, and, after our supplies are unloaded from sea-going vessels, it is almost impossible to have them extricated from other materials so they can be headed on up the river by small boat or barge. Unquestionably, most of this congestion was caused by the recent civil war in Paraguay, and conditions, or so I am informed, are not so bad as they were a few months ago. However, there is still much room for improvement.

THE AUTHOR

C. S. Perkins, who is assistant manager of purchases for Union Oil Company of California, recently made a trip to Paraguay to observe the geophysical and drilling operations on the company's concession, and learn first hand what problems of supply required immediate attention. The length of the supply route—more than 12,500 miles from Los Angeles to Puerto Casado by water—involves four or five transshipments. Purchasing problems in the United States occasioned by scarcities of materials, revolutions in Paraguay, and congestion in the Port of Buenos Aires add to the difficulties his company is encountering in carrying on this foreign operation. In this article he tells of his trip and the problems of transshipping supplies in the field.

The Drilling and Exploration Company is embarking on a six-string program for the Argentine Government, and it may be possible for us, in conjunction with Drilling and Exploration Company, to retain some Argentinean who is familiar with dock operations, to handle transshipment of materials.

I left Buenos Aires Sunday morning about 7 o'clock for Asuncion, arriving a little after noon, where I was met by Chester Cassel, Newell Williams, Fritz Skinner, and Stan Martin. Clearing customs at this point was accomplished without delay, and my luggage was practically taken from the plane to the car. After a stop at Chet Cassel's home, I was taken on to the hotel where an attempt was made to get some much needed sleep, but this was almost impossible due to the heat.

Sunday evening, Chet Cassel had a dinner party for all personnel of the Asuncion office, and I had an opportunity to meet them for the first time.

Monday, after a short visit to the office, Stan Martin and I left on the river boat "Iris" for Puerto Casado, arriving there Wednesday morning about 9:30. The Paraguayan River is quite large, and reminds one somewhat of the Mississippi. It is navigable for fairly large boats clear up into Brazil. The service on the boat is exceptionally good, and the staterooms are very clean. I recommend, however, that anyone making this trip forego an inspection of the kitchen facilities.

Mr. McClaine, general manager for Carlos Casado, was very hospitable and took us on a tour of his facilities, which include a fairly well equipped machine shop, wood working shop, auto repair shop, and commissary, which are used in connection with the Quebracho industry, and available to us on a limited scale.

That evening, we left on the narrow gauge railroad by autovia, which is a Model A Ford with railroad wheels, arriving at Kilometer 83 about two and one-half hours later. Kilometer 83 is the location of Western Geophysical Company's Party No. 2. This location was made by clearing an area in the jungles, and setting up several tents for the housing of the crew, which consists of approximately 50 men, for carrying on geophysical operations in that area. The weather was very hot and humid, and it rained almost every day. The mosquitoes and poverines were active, and made life somewhat miserable for those in the camp, as well as myself. The tents and beds were very comfortable, and the food exceptionally good.

I spent part of one day out in the field with a geophysical crew, and it is a most rugged life. As the crew's work is carried on in the jungles, it is necessary for the tractors to go through first and clear a road that is no more than a cow trail. This is followed by the drill trucks, which drill a shot hole every 300 meters. At this point, these holes are drilled approximately 60 ft deep. The drill truck is followed by the shooter's truck, which plants the dynamite charge in the hole, then the recording truck follows up. After laying their lines, the shot is discharged, and the reflections are recorded. This operation is a little more difficult at this time of the year due to the rainy season, as almost all the equipment has to be dragged by caterpillar tractors.

The jungle is dense and thorny, and the bugs are worse than at camp. However, the morale of the boys is high, and a lot of work is accomplished even under extremely adverse conditions. On this particular crew, there are only two Americans in the field, the rest being Paraguayans who are doing very satisfactory work. It was necessary to spend a couple of extra days with this group, as the rains did not permit transportation over the Military Road from Kilometer 160 to Mariscal Estigarribia. However, on Sunday, permission was obtained from the Military to travel the road, and we arrived at our headquarters in the Chaco that evening.

Our headquarters are just outside the Fort at Mariscal Estigarribia, and consist of an obrero camp, housing approximately 100 native laborers; an engineers' and empleados' camp, for approximately 20 Paraguayan employes, and quarters for the American personnel. Also, there are an auto repair shop, a welding shop, and a large warehouse for storage of all material used on the Paraguayan project. These warehouses, or depositos as they are called, are located in three different places. The main warehouse contains about 9000 sq ft, and is used to store all the automotive parts, drilling rig parts, camp supplies, etc. The building is of frame construction with palm logs split in half for siding, and a corrugated asphalt paper roof. The roof is very poor, being made with second-hand material containing numerous holes. When you have two inches of rain outside, there are apparently three inches inside. Of course, this condition will be corrected when the shipments of corrugated iron and aluminum are received in Paraguay.

There is another building that is called a food deposito, which is situated near the kitchen. This building is too small to take care of all the foodstuffs that are shipped down from the states, and a new warehouse is being built on to the main warehouse to take care of this problem.

Across the road, and about 200 yards from the main warehouse, is another building housing all the tires, which, at the present, number approximately 250. Oils and greases are also stored at this point, as well as gasoline and diesel fuel.

Our warehouses, at the present time, are well stocked. This inventory consists of approximately 15,000 items from the smallest tractor part to a large replacement item for a drilling rig. The warehouse has one American, Gene Loper, in charge, and a crew of Paraguayans to handle the receipts and withdrawals. Gene is doing an exceptionally good job in training the Paraguayans to handle this work, and, by a process of elimination, has developed a crew that is quite familiar with the material, particularly the automotive and tractor parts, which make up a large portion of the inventory.

I had occasion to observe the arrival of several tons of boxes containing materials shipped from the States, and was very much disappointed at their condition on arrival. Many changes are being made in our packing methods at this end so that losses and damages can be reduced to an absolute minimum.

The radio shack is attached to the warehouse, and contact is made each morning beginning at 7:00, and each evening starting at 4:30, with the three geophysical camps, the drilling well at La Paz and also Asuncion. Requisitions for materials are taken over the radio and shipped to the various groups as transportation is available.

Chet Cassel came up by plane from Asuncion, and we first went out to the drilling well, which is approximately 55 kilometers west of the main camp. On this trip, and again on one other trip before leaving the Chaco, I had the opportunity of talking with mechanics and drillers to see how our service could be improved, and what types of equipment were giving them trouble. I also discussed with Dr. Gomez the supplies for our completely equipped emergency hospital, which is maintained at the drilling site.

The next day Chet Cassel, Gene Loper, Art Woodbridge, a Western Geophysical driller, John Stollard, the Paraguayan tractor foreman, and I took a trip up to Party No. 3, in a Dodge 4-Wheel Drive Power Wagon. Party No. 3 is operating 212 kilometers northwest of the main camp, and up close to the Bolivian Line, at a spot called Pequiba. This was an interesting but rugged trip, as the roads were almost impassable and it was necessary, even with a 4-wheel drive truck, to haul out the winch line and pull the truck out of the mud holes. The jungles are rather dense and infested with insects.

We arrived at Party No. 3, after 16 hours of travel and one sandwich, a really tired group. After a few hours of rest, we discussed our mutual problems with the party chief and his group and found that they were not too numerous.

All the camps are equipped with good tents, good beds, and the food supply is adequate, although at this particular camp fresh meat was lacking as they had recently moved to the area and cattle were not readily available. Incidentally, the location of this camp is on one of the old battle fields of the Chaco War, and it is said that many Bolivians perished there because of lack of water. We have been successful, however, in developing, at about 190 ft, one of our best fresh water wells in the Chaco. Spent ammunition, machine gun parts, and old bombs are scattered over quite an area. An old air strip, used by the Bolivians, was found and cleared off so that our DC-3 could land. Fresh meat is now taken in by this method, as well as supplies and personnel.

The trip back from Pequiba to Mariscal Estigarribia was made on a Ford Marmon Herrington Truck.

The following day, after my arrival at Mariscal Estigarribia, a meeting of all the supervisors in the Chaco was called, and considerable time was consumed in discussing our mutual problems, and possible solutions for the difficulties that we had encountered. This meeting was attended by Harris Cox, Western Geophysical's manager, as well as Chet Cassell. After spending a few more days in camp going over our warehouse stocks thoroughly with Gene Loper, arrangements were completed to return to Asuncion by river boat, as it was necessary to send our plane to Brazil for a drilling line, and a delay of a few more days would have been necessary to use that means of transportation.

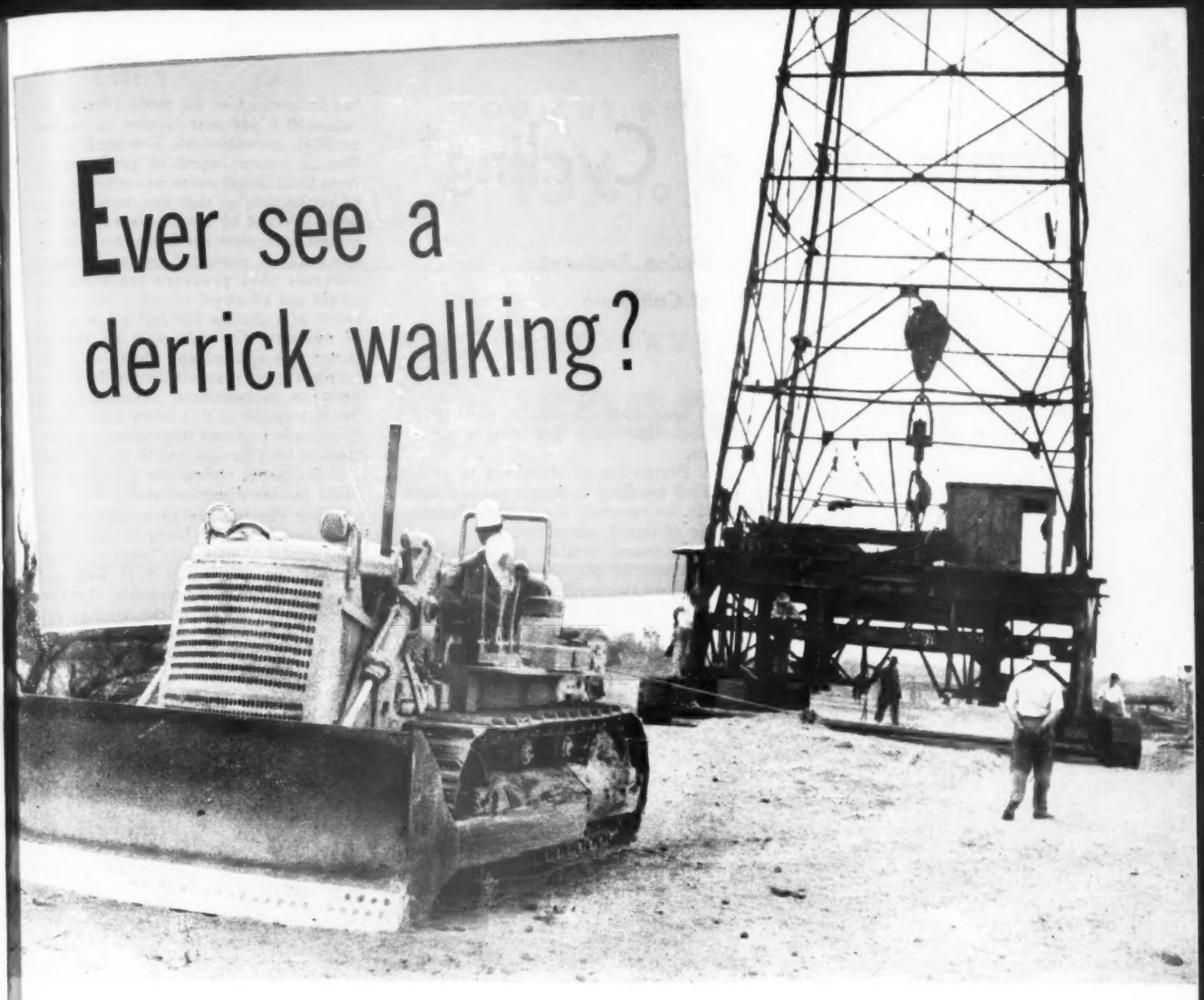
The return trip included a one-night stopover at Party No. 2, on the railroad, and we arrived in Asuncion three days later without incident.

The following Monday, a meeting of all supervisory employes was called by Chet Cassel to discuss ways and means of improving the requisitioning, purchasing, and shipping procedures. I had occasion to point out that the supply route was one of the longest in the world, being more than 12,500 miles from Los Angeles to Puerto Casado by water, involving a minimum of four or five transshipments. Added to this, are purchasing problems in the United States created by scarcities of material and serious delays caused by strikes; also revolutions in Paraguay, and congestion in the Port of Buenos Aires. Packing methods, preparation of requisitions, food supplies, prices, and many other things were also discussed.

On March 9, a meeting was held with the accounting group, and many changes were made in the warehouse accounting procedure, which will simplify the handling of materials and permit better control. The new system will make the delivered price available to the men in the Chaco so that they will be familiar with costs, enabling them to make more accurate estimates on the cost of each job.

I left Asuncion on March 11, by Pan American Brazil, for Rio de Janeiro with stops at Iguassu Falls and Curityba, arriving in Rio that evening. I was scheduled to leave Rio Saturday afternoon at 4 o'clock, but due to the rains all flights were delayed, and we were not permitted to take off until 2 a.m. Monday, arriving at San Juan, Puerto Rico, late that night with stops at Belem and Trinidad. I left San Juan the next morning, and arrived in Miami Tuesday afternoon, March 16, having traveled approximately 21,000 air miles during my trip. * * *

Ever see a derrick walking?



Anchored by its tracks and 'dozer, this "Caterpillar" Diesel D7 Tractor, owned by R. C. Rumbaugh & Sons, Odessa, Texas, pulls a complete oil derrick across country by means of its Hyster towing winch.

MOVING a drill rig across country offers no problem to R. C. Rumbaugh & Sons, oil-field contractors. They simply put dual Athey truss wheels under the four corners of the rig, hook up to a "Caterpillar" Diesel Tractor with Hyster towing winch, and away they go. The 122-foot derrick is moved complete, without dismantling. Over loose Texas earth, where there are no roads, this husky puller moves the rig along at nearly two miles an hour!

The D7 is equipped with a bulldozer, and as soon as it delivers its load to the new location it's ready to go to work digging slush pits and doing other earthmoving jobs.

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Economics of Cycling*

By M. G. ARTHUR, Production Engineer,
Union Oil Company of California

● **Abstract:** Development of the material presented in this paper was instigated by study of the subject by the API Pacific Coast District Topical Committee on Production Technology under the chairmanship of N. van Wingen. The scope of the paper covers a brief review of the factors affecting recovery by gas injection into so-called "black oil reservoirs," and a detailed discussion of the economics of cycling of condensate reservoirs. Black oil reservoirs are those in which part of the hydrocarbon mixture contained was initially in the liquid phase. Condensate reservoirs are those in which the hydrocarbon mixture was initially in the gas phase and from which liquid condenses as pressure is reduced from the initial value. This retrograde type of condensation progresses to some value of pressure below which the liquid material partially revaporizes.

It is hazardous to make broad general conclusions regarding the economics of methods of gas injection. In black oil reservoirs it is usually profitable to maintain reservoir pressure at high values but in some cases where the reservoir permeabilities are extremely high the economically recoverable oil may be greatest for cycling at rather low pressures. Comparison of net profits with reservoir pressure at which gas is injected into black oil fields is not considered in this paper. For a given condensate field it does not appear possible to determine the most profitable method of gas injection without careful consideration of many factors.

● **Pressure maintenance in black oil reservoirs.** Advantages of pressure maintenance have been discussed previously by authors and speakers including T. H. Acres[1], N. van Wingen[2], E. C. Babson[3] and R. L. Hoss[4]. Recently E. C. Patton, Jr.[5] presented a comprehensive paper on the data and methods of determining the value of pressure maintenance.

Following is a tabulation of some of the advantages of pressure maintenance:

1. Prevention of increase in oil viscosity thereby facilitating flow of oil to the well bore and permitting profitable production to lower oil saturation in the reservoir pores. As will be shown, this is not a controlling factor throughout the entire pressure range and higher recoveries may be obtained at low pressures if permeabilities of the reservoir rock are sufficiently high to yield profitable production at low reservoir pressures.
2. Prevention of shrinkage of reservoir oil resulting in lower residual tank oil in the reservoir for a given limiting value of liquid saturation.
3. Increased facility to control encroachment of edgewater and superior water flood sweep efficiency due to lower viscosity of reservoir oil.
4. Prevention of encroachment of black oil into the gas cap where much of it that wets the gas bearing sand cannot be economically recovered by present methods.
5. Maintenance of higher oil production rates to shorten the life of the field and give a quicker return on the investment and a greater present worth of future profits.
6. Extension of the flowing life of the field resulting in lower operating costs.
7. Reduction of development costs in cases where fewer wells are required to deplete the field in a comparable period of time.
8. Possible elimination of secondary recovery costs following natural depletion when recovery rates and profit per barrel of oil produced would be comparatively low.

The economic analyses by van Wingen[2] and Hoss[4] show that pressure maintenance increases oil recovery but that it has little effect on the profit after application of 6 per cent interest to convert profit to present worth. The small variation in present worth of profit results from their assumptions of curtailed rate of production so that the increased income is offset by the increased time required to deplete the fields. An alternative analysis presented by van Wingen[2] assumes that pressure maintenance would not affect oil recovery but would result in a shorter life and a lower cost of recovery. For this case, no interest factor was applied and the value of future profits was essentially unaffected by pressure maintenance. Application of interest factor to this latter case would have made pressure maintenance advantageous on a present worth basis. Table 1 of this paper reviews the recovery and profit factors discussed above.

Using the relative permeability data published by M. C. Leverett and W. B. Lewis[6] and Dominguez reservoir fluid properties published by B. H. Sage and W. N. Lacey[7], the relationship of oil recovery by gas drive to the average reservoir pressure at which gas drive is conducted has been calculated and is presented in Fig. 1. The equation employed appears on the chart and the nomenclature is presented at the end of the paper. As reservoir pressure is reduced, the recovery to a given producing gas-oil ratio decreases to a minimum value and then increases rather sharply as pressure is further reduced. In reservoirs of comparatively low ratio of permeability to viscosity of reservoir oil, the rates of production in the pressure range below the minimum recovery pressure are unprofitable. In reservoirs of sufficiently high permeability-viscosity ratio to yield profitable production rates at low pressure, the profit from depletion followed by low pressure cycling may not be greater than the profit from high pressure cycling. Although the curves of Fig. 1 are based on laboratory permeability tests of unconsolidated sand and on the assumption of homogeneous

Table 1. Review of pressure maintenance recovery and profit factors.

Babson[3]—Estimated recovery for specific assumptions of reservoir rock and fluid characteristics.

Oil recovery without pressure maintenance		Oil recovery with pressure maintenance		Increased oil recovery
Bbl/acre-ft	Per cent	Bbl/acre-ft	Per cent	Per cent
300	32.4	599	64.8	100
400	43.2	642	69.4	61
500	54.0	679	73.4	36

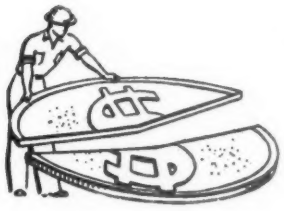
Van Wingen[2]

Produced gas returned, per cent	Oil recovery, per cent	Increased recovery, per cent	Future profit, MM $	Present worth at 6 per cent, MM $	Future profit for constant recovery MM $
0	25.6	0	25.75	14.65	25.75
32.3	37.7	47.3	40.66	20.31	25.56
70.3	44.7	74.5	49.94	22.30	26.83
130.8	52.5	105.0	59.37	24.08	26.95

Hoss[4]

Produced gas returned, per cent	Oil recovery, per cent	Increased oil recovery, per cent
0	26.5	..
35	28.9	13
60	31.2	18

*Presented before the Spring Meeting of the Pacific Coast District, Division of Production, American Petroleum Institute, Los Angeles, California, May 6-7, 1948.



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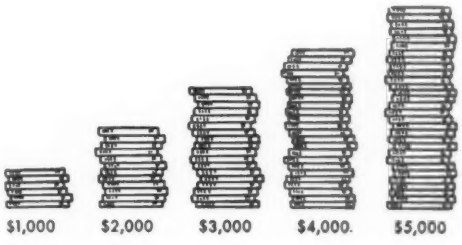

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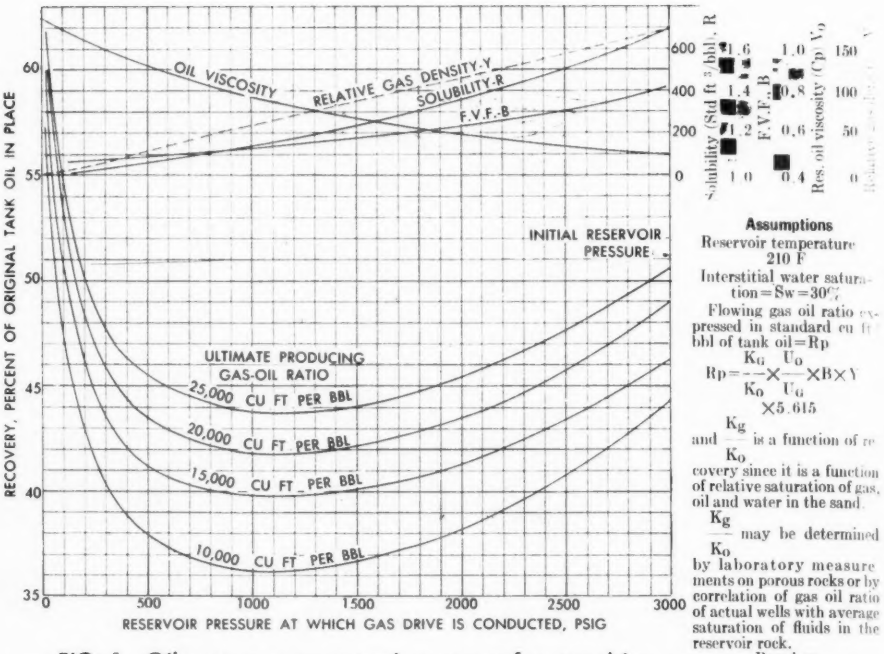
sand, similar calculations using relative permeabilities determined by well performance and consideration of variation in permeability give the same type of curves as those presented in Fig. 1.

● **Cycling of condensate reservoirs.** Evaluation and discussion of cycling, whereby dry gas is injected into condensate reservoirs to sustain reservoir pressure and to drive wet gas to producing wells, has received considerable attention in the literature of petroleum technology. Emby Kaye[8] discussed some of the economic factors in his paper published in 1942. W. Hurst and A. F. van Everdingen[9] analyzed the influence of permeability variation and sweep pattern on condensate recovery.

Standing, Lindblad, and Parsons[10] presented a stimulating and controversial paper in which they concluded that recovery of butanes and heavier components from a wet gas is greatest if the reservoir pressure is allowed to decline to low value prior to cycling of dry gas. However, the paper did not consider the relative profits from cycling at different pressures or the limitations placed on recovery by the economic factors. Valuable data were contributed on the ability of condensate in the reservoir to be revaporized by reduction in pressure to low values or by contact with dry gas at constant pressure. The paper investigated the effect on recovery of permeability variation, sweep pattern, and cycling at a wide range of pressures, but the authors did not consider the recovery to be obtained by depletion subsequent to the cycling period.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F.V.F.-B
INITIAL RESERVOIR PRESSURE
ULTIMATE PRODUCING GAS-OIL RATIO
25,000 CU FT PER BBL
20,000 CU FT PER BBL
15,000 CU FT PER BBL
10,000 CU FT PER BBL
RESERVOIR PRESSURE AT WHICH GAS DRIVE IS CONDUCTED, PSIG
Solubility (Std ft³/bbl), R
F.V.F., B
Res. oil viscosity (Cp), Vo
Assumptions
Reservoir temperature 210 F
Interstitial water saturation = Sw = 30%
Flowing gas oil ratio expressed in standard cu ft/bbl of tank oil = Rp
Rp = (Kg/Ko) × (Uo/Ug) × B × γ × 5.615
Kg/Ko is a function of recovery since it is a function of relative saturation of gas, oil and water in the sand.
Kg/Ko may be determined by laboratory measurements on porous rocks or by correlation of gas oil ratio of actual wells with average saturation of fluids in the reservoir rock.
Based on Dominguez P.V.T. data
M. G. Arthur 1943

FIG. 1. Oil recovery vs reservoir pressure for gas drive.

In an address before the California Natural Gasoline Association on October 10, 1946, discussed in general terms some of the economic factors that should be considered in the analyses published by Standing, Lindblad, and Parsons[10].

A current series of articles by M. G. Miller and M. R. Lents[17] contend that some condensate reservoirs are not suitable for cycling, and the increasing demand for gas makes it advisable to examine each field critically before deciding on the most desirable program.

In an evaluation of factors influencing cycling of condensate reservoirs, Wm. H. Justice[12] concludes that there is no simple and fixed answer to the question of optimum cycling method and this conclusion is apparently very sound. Factors outlined by Justice included the amount of retrograde loss, field reserves, extent of natural water drive, difference in recovery of condensate in field separator or in modern recovery plant, rate of condensate recovery and limitation of rate by the daily gas demand for the depletion method, and the marketing flex-

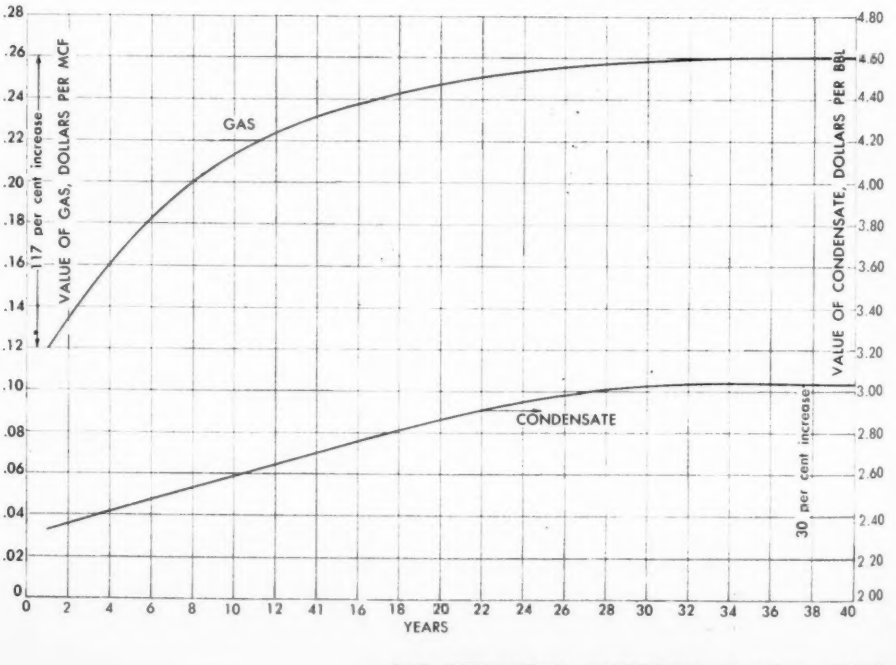
Table 2. Assumptions for hypothetical case of cycling of condensate reservoir.

Hydrocarbon composition—given by Standing, Lindbal and ParsonsP	
Initial reservoir pressure (dew point), psi	2,960.
Depth of reservoir, ft	6,900.
Original reserve:	
Wet gas, std. M cu ft	300,000,000.
Butanes and heavier, bbl	38,550,000.
Porosity, per cent	20.
Average permeability (arithmetic):	
Reservoir effective, md	8.
Air, md	±50.
Permeability variation*	0.55
Average interstitial water, per cent	38.
Productive sand thickness, ft	200.
Area of productive sand, acres	1,360.
Macroscopic coverage (lateral sweep efficiency), per cent	75.
Size of gas plant std. M cu ft wet gas/day	70,000.
Costs:	
Development, $/well	70,000.
Gathering system, $/well	10,000.
Field operating, $/day/well	3.00
Well repair, $/day/well	1.50
(Accumulated at 4 per cent interest for 25 year period this amounts to 32.6 per cent of initial cost of wells.)	
Royalty computed on products sold	1/6
Ad valorem taxes, per cent of net profits	8.0
Plant costs, estimated by B. B. Kuist and T. Weaver of The Fluor Corp.:	
Annual plant maintenance, per cent of investment	5.0
Annual plant labor, per cent of investment	8.0
Fuel 0.9 MM cu ft/yr/gal/1,000,000 cu ft in absorbers.	
2.2 MM cu ft/yr/gal/1,000,000 cu ft in fractionators	
0.088 MM cu ft/yr/installed compressor brake-horsepower.	
Interest rate to convert future profits to present worth, per cent compounded annually	4.0
Price of products (current values):	
Condensate, $/bbl	2.24
Gas, cents, per M cu ft	12.

Profits were estimated on constant future price of products and also on increasing prices as presented in Fig. 2.

*As defined by Standing, Lindblad and Parsons[10].

FIG. 2. Estimated future value of products for condensate field.



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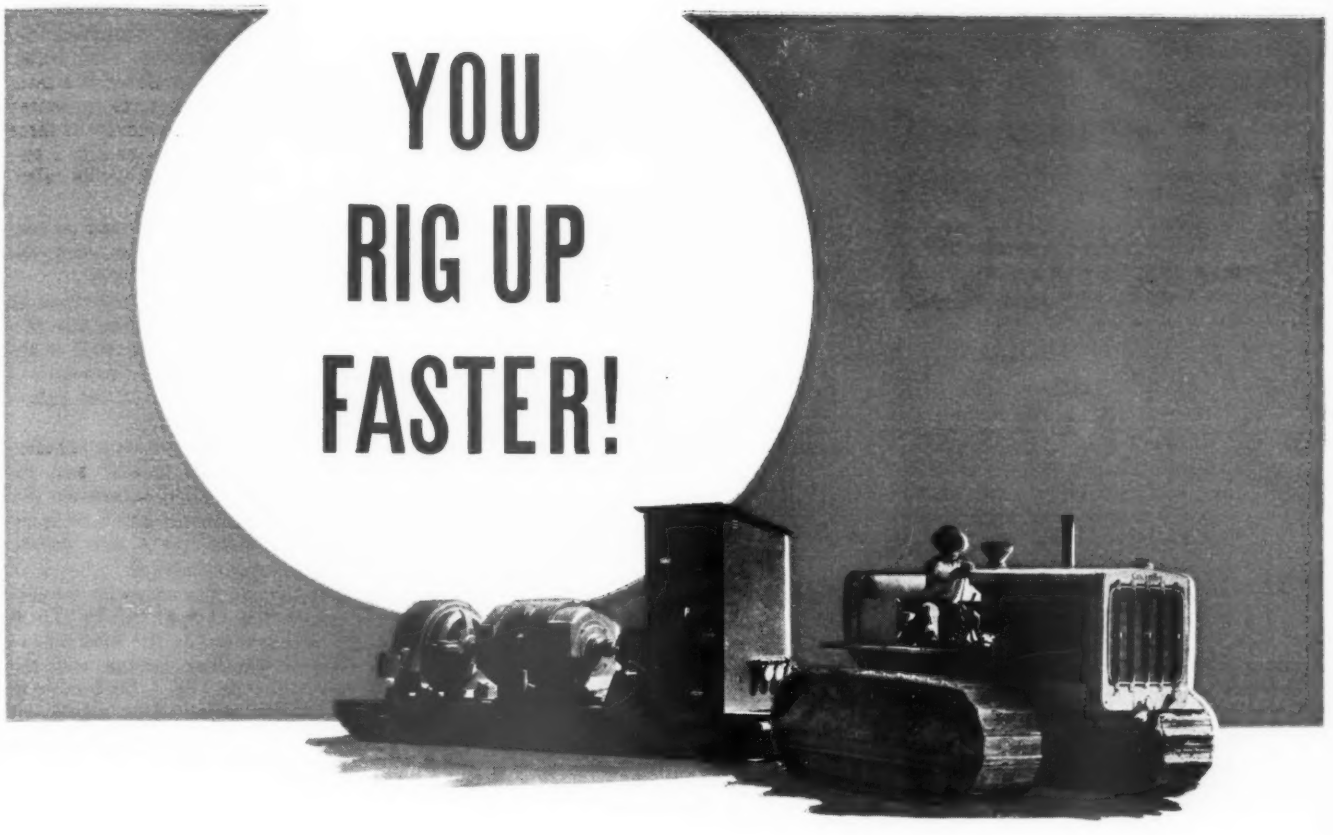

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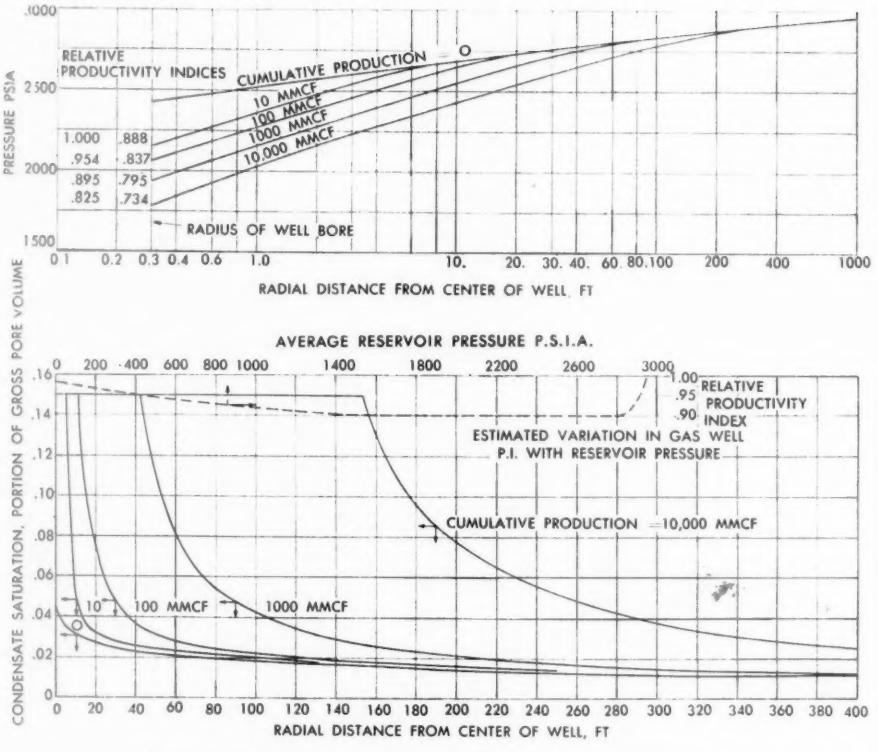


FIG. 3. Effect of liquid condensation on reservoir pressure gradients and on gas well productivity index.

ibility afforded by cycling. In a hypothetical example outlined below, Justice did not evaluate the profit from the methods presented.

Components recovered	Per cent recovery by cycling, then depletion to 500 psi	Per cent recovery by depletion to 500 psi
Pentanes and heavier	87.8	61.0
Butanes and heavier	93.8	75.8

● **Evaluation of a hypothetical case.** Economics of several methods of cycling were evaluated for the reservoir assumptions outlined in Table 2 and containing the hydrocarbon composition employed by Standing, Lindblad, and Parsons[10]. The analyses were based both on constant future price of products and on increasing future price as presented in Fig. 2. As it is believed that prices of oil and gas may increase compared to the prices of other commodities, the profits were evaluated for the arbitrary price increases to illustrate the effect of this price factor. The value of gas compared to $2.10 per bbl fuel oil amounts to 39 cents per M cu ft when computed on a Btu content basis. According to A. F. Bridge[13], the cost of Texas gas delivered to California, based on constant well head price of 4 cents per M cu ft, will be 20.3 cents per M cu ft for the first year of operation of the new pipe line. This will decline to 16.5 cents per M cu ft in 1951. However, there is no assurance that the well head price of 4 cents per M cu ft will remain constant for a long period of time. Consequently, it is believed that the gas price increase from 12 cents per M cu ft to 26 cents per M cu ft as shown on Fig. 2 may be a conservative estimate for California conditions.

In evaluating performance of the hypothetical condensate field it was necessary to investigate several factors. The first of these was the effect on well productivity of accumulation of condensate in the reservoir as pressure is reduced due to depletion and pressure gradients. Examination of actual gas productivity indices in several California condensate fields showed such erratic behavior that the degree of decline could not be adequately established. Therfore, the change in gas permeability with reduction in pressure was calculated in a manner similar to the calculations presented by Vaughn Moyer[14]. The results of these calculations are presented in Fig. 3 and result from the following stepwise calculation.

1. For a given rate of flow and no condensate accumulation in the sand. the pressure gradient is determined.

2. The amount and distribution of condensate accumulated during flow of a given quantity of gas to the well at the above pressure gradient is determined from the phase behavior of the hydrocarbon mixture.

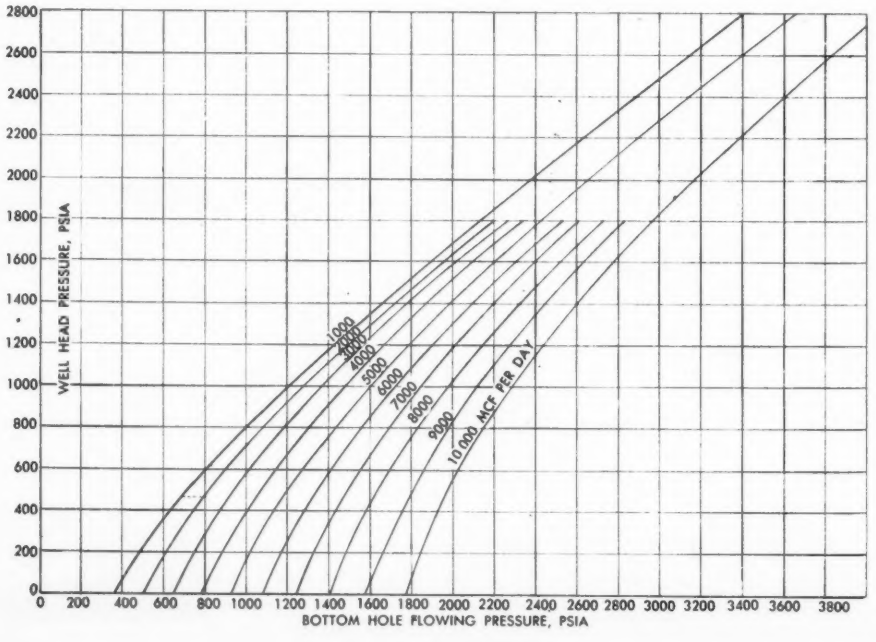
3. From the relative permeability data of Leverett and Lewis[6] and the above determined liquid saturation distribution, a new pressure gradient is determined and from this a new saturation distribution calculated.

Continuation of this stepwise process yields the decline of productivity indices that are proportional to the intercept of the pressure gradient curves with the well bore radius in Fig. 3. Reduction of the size of the steps taken would not appreciably change the results. The curves of Fig. 3 only apply as long as there is no break-through of dry gas to revaporize a part of the condensed material. In practice, the productivity decline would be less severe because of this breakthrough of dry gas in the more permeable streaks. It is apparent that the decline in productivity indices is not great, and examination of the above analysis and actual well performance data resulted in the selection of productivity index variation with reservoir pressure as shown on Fig. 3.

Rate of flow of gas into the well bore and the rate of gas injection is deter-

FIG. 4. Estimated relationship of bottom hole to surface pressure for flow of condensate wells.

Production from 6900 ft. *Based on combination of calculations and field data*



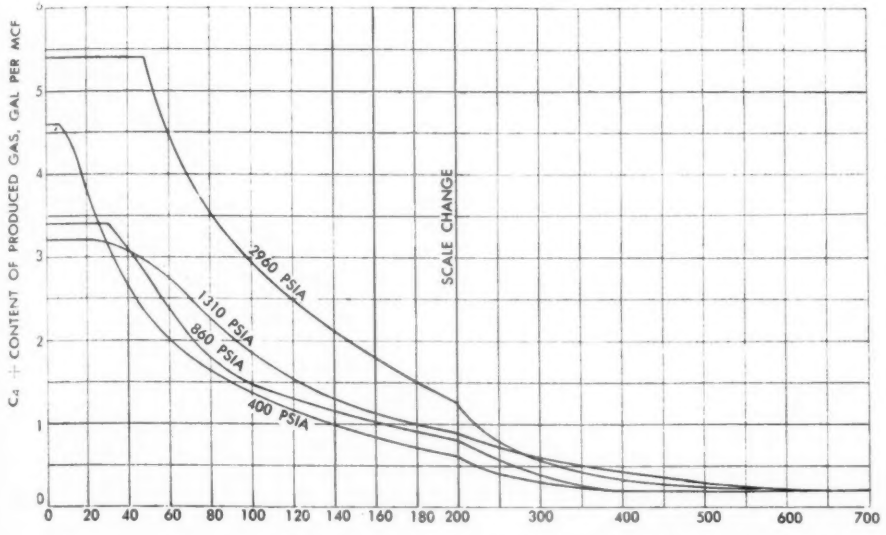


FIG. 5. Butanes and heavier content of produced gas. Permeability variation 0.55—75 per cent macroscopic coverage by injected gas. Based on data from Standing, Lindblad & Parsons A.I.M.E. T.P. 2200.

mined by the following radial flow equation derived from Darcy's Law†.

$$Q = \frac{8.46 \times 10^{-3}\, h\, K_g\, (P_e^2 - P_w^2)}{U_g\, P_b \log \frac{r_e}{r_w}}$$

In this equation the variation in productivity index is expressed by the relative variation in gas permeability, K_g.

†Nonmenclature is at the end of the paper.

The flowing pressure drop in the well tubing presented in Fig. 4 is based on calculations outlined by E. L. Rawlins and M. A. Schellhardt[15]. The calculated curves were modified at low pressures to coincide with actual condensate well test data. At high pressures the calculated values checked with well test data.

Fig. 5 shows the butanes and heavier components of the produced gas. The curves are similar to those presented in the paper of Standing, Lindblad and Parsons[10], but are adjusted to 75 per cent macroscopic coverage.

Size of the gas plant and related rate of production has an optimum value to yield greatest profit. However, they must also conform to the market demand for products, the capital available for the specific operation, and the ability to reinvest earnings at a satisfactory rate of return to avoid liquidation. Consideration of published discussions and examiation of the size of gas plants in use influenced the selection of a plant capacity of 70,000,000 cu ft per day for this hypothetical field.

Conversion of future profits to present worth is valid if the rate employed expresses the cost of hiring capital. The rate of 4 per cent chosen for this analysis is based on the average payments to owners of oil stocks reported by Pogue and Conqueron[16] of Chase National Bank in their financial analysis of 30 oil companies.

Application of the above factors to the hypothetical field described in Table 2 permits prediction of performance and profits. The following three methods of operation are considered:

Case I—Cycling at initial reservoir pressure of 2960 psi until condensate yield reaches approximately 1 gal of butanes and heavier per 1,000,000 cu ft. then depletion to the economic limit.

Case II—Depletion from initial pres-

FIG. 6. Production rates from a condensate field.

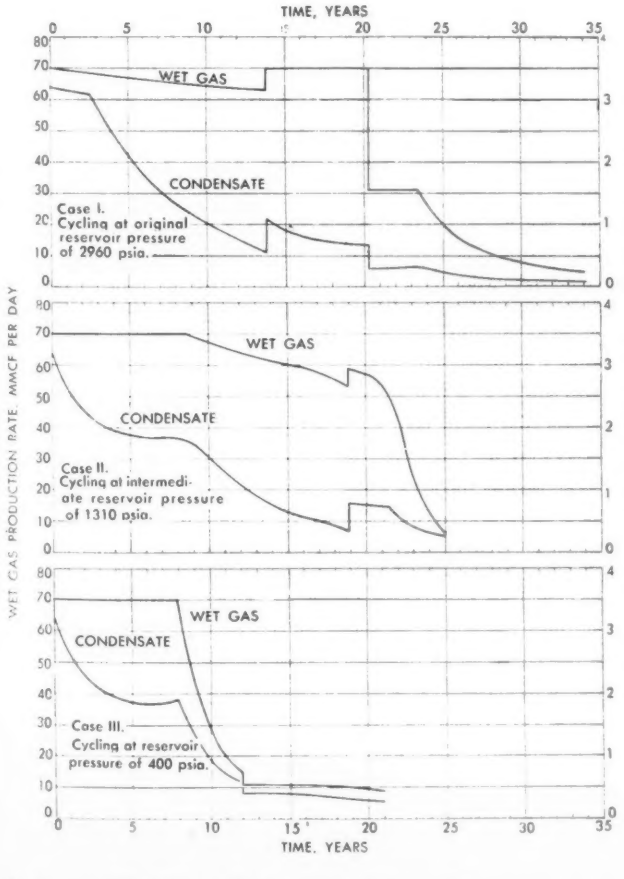
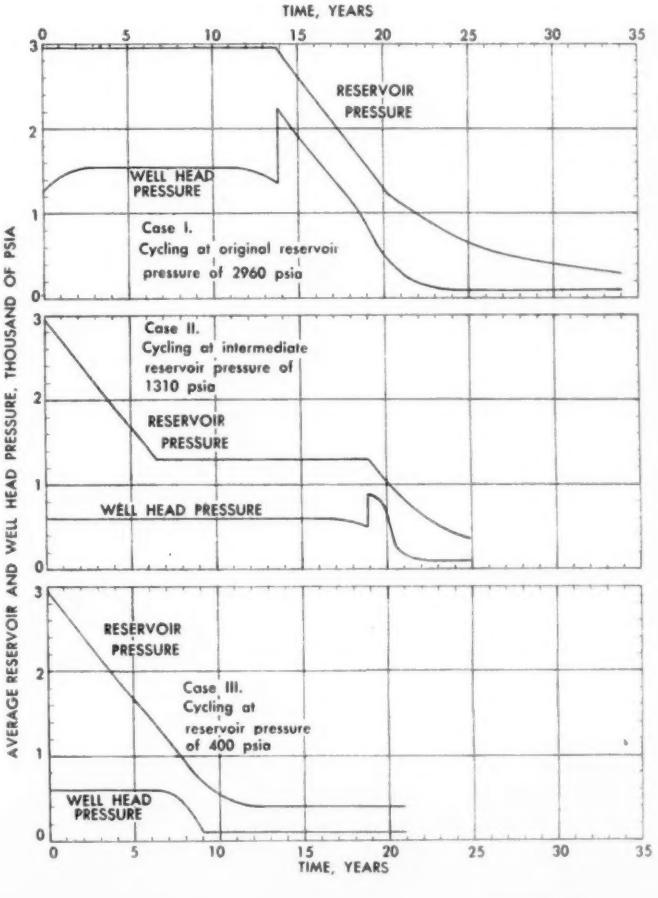

TIME, YEARS
WET GAS
CONDENSATE
Case I. Cycling at original reservoir pressure of 2960 psia.
WET GAS
CONDENSATE
Case II. Cycling at intermediate reservoir pressure of 1310 psia.
WET GAS
CONDENSATE
Case III. Cycling at reservoir pressure of 400 psia.
WET GAS PRODUCTION RATE, MMCF PER DAY
CONDENSATE PRODUCTION RATE, MILLIONS OF BBL PER YEAR
TIME, YEARS

FIG. 7. Pressure histories for a condensate field.


TIME, YEARS
RESERVOIR PRESSURE
WELL HEAD PRESSURE
Case I. Cycling at original reservoir pressure of 2960 psia
Case II. Cycling at intermediate reservoir pressure of 1310 psia
RESERVOIR PRESSURE
WELL HEAD PRESSURE
RESERVOIR PRESSURE
Case III. Cycling at reservoir pressure of 400 psia
WELL HEAD PRESSURE
AVERAGE RESERVOIR AND WELL HEAD PRESSURE, THOUSAND OF PSIA
TIME, YEARS

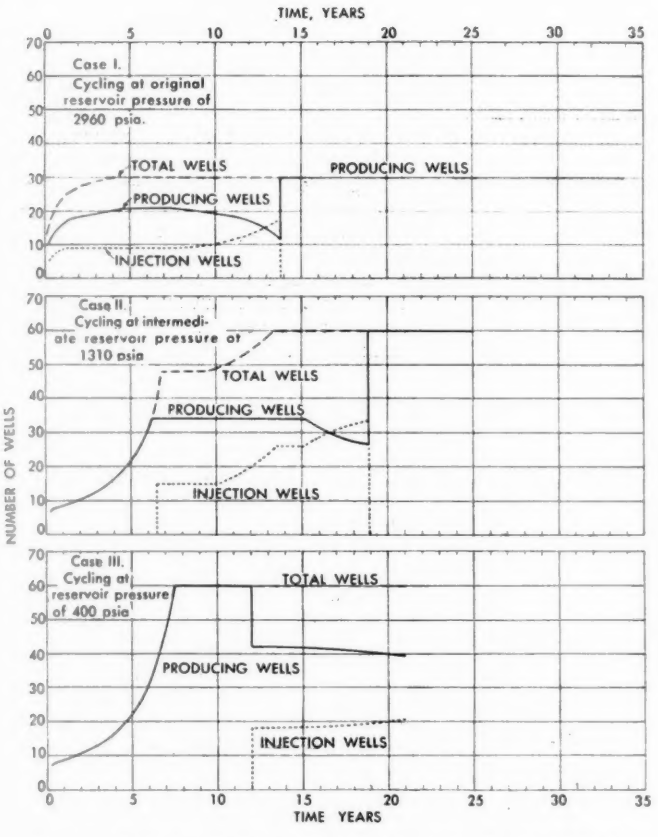


FIG. 8. *Relative number of wells for a condensate field.*

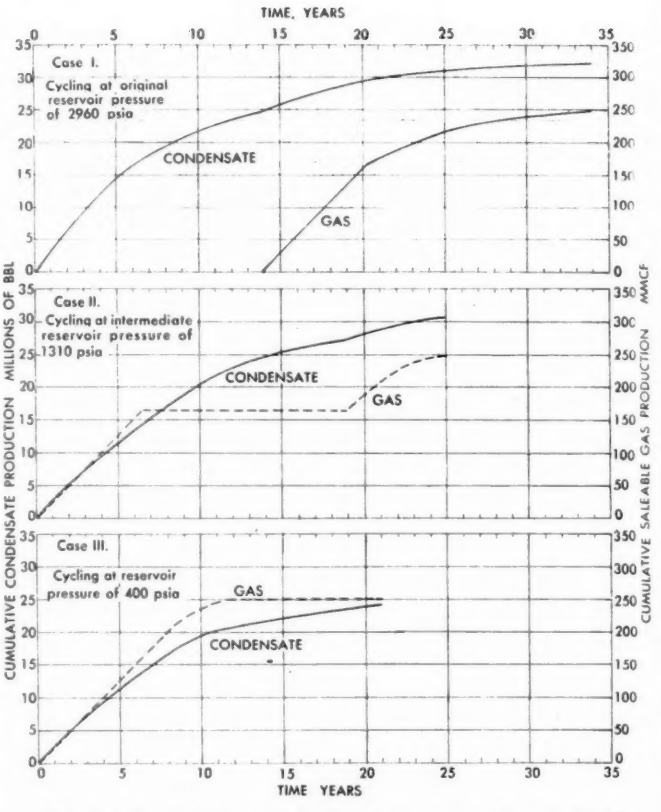


FIG. 9. *Cumulative production from a condensate field.*

sure to an intermediate reservoir pressure of 1310 psia. Cycling at 1310 psia to a similar minimum yield followed by depletion to the economic limit.

Case III—Depletion from initial pressure to a reservoir pressure of 400 psia followed by cycling to the economic limit.

Each of the above cases was determined for constant and for increasing future price of products. The producing histories for the three cases are presented in Figs. 6, 7, 8, and 9 which show respectively the production rates, the pressure declines, the number of wells, and the cumulative production of condensate and salable gas. The number of wells for each case are established by the requirement of producing the plant capacity during a reasonable portion of the producing life. Fewer wells than those chosen would reduce initial present worth profit and more wells would be unnecessary for the size of plant chosen. For Case I, there are 30 wells with a spacing of 45 acres per well and for Cases II and III there are 60 wells with a spacing of 22½ acres per well.

It was assumed that reservoir pressure would remain constant during the cycling periods when all residue gas was returned to the reservoir. Although this is not the case, it is approximately correct for this particular reservoir because the difference in the deviation factor of the wet and dry gases is large enough to account for much of the extraction shrinkage and plant fuel. The amount of gas cycled was 1.128 of the total reservoir pore volume for the high pressure cycling, 0.96 reservoir pore volume injected for the intermediate pressure cycling and 0.97 pore volume injected for the low pressure cycling.

Fig. 10 correlates these results with the curves of Standing, Lindblad and Parsons[10]. Superimposed on the Standing, Lindblad, and Parsons curves are the recoveries to the economic limit for the cases investigated herein. Although the previously published curves extended to much higher recoveries at greater amounts of gas injected than shown in Fig. 10, a large portion of the curves are beyond the economic limit of operations.

Table 3 is a summary of the recoveries, incomes, costs, and profits under the various examples treated. Although recoveries of condensate are highest for cycling at original reservoir pressure, the present worth profits for the conditions of the example are not proportional with the recoveries because of the influence of the interest factor and costs. It should be noted that there is one advantage of the intermediate pressure chosen for cycling that is not evident from the data presented. As cycling pressures are reduced, each unit of gas measured at standard conditions which is injected is more effective in purging the formation of wet gas because of the larger reservoir volume occupied by the standard gas volume at lower reservoir pressure. The practical limitation of this factor is determined by the maximum producing rate from a reasonable number of wells. At the intermediate pressure chosen of 1310 psia, the wells are capable of supplying the selected plant capacity during the period of cycling. As well producing capacity declines rapidly with pressure, cycling at pressures appreciably below 1310 psia would have necessitated drilling a considerable number of wells to meet the fixed demand and the producing life would only be shortened during the short period of depletion following cycling operations.

On Fig. 11 are shown the relative present worth profits accruing from the various cases considered and on this basis there is little to choose between the cases except for the relative time required to complete the exhaustion of the field. For the cases based on constant future price of products, the intermediate pressure cycling is most profitable and the high pressure cycling is least profitable. On the basis of assumed increasing price of products, there is an advantage to delaying salable gas production, and the high pressure cycling is very slightly more profitable than the intermediate pressure cycling. For increasing prices the low pressure cycling is least profitable.

The optimum size of plant to yield greatest ultimate profit was evaluated for the cases based on constant future price of products and the results are presented in Fig. 12. As the number of wells required are related to the plant size, they were varied proportionally to the plant sizes. It is evident that the size of 70,000,000 cu ft per day plant chosen for the preceding analyses was below the optimum size of plant for high pres-

Every Joint a strong point

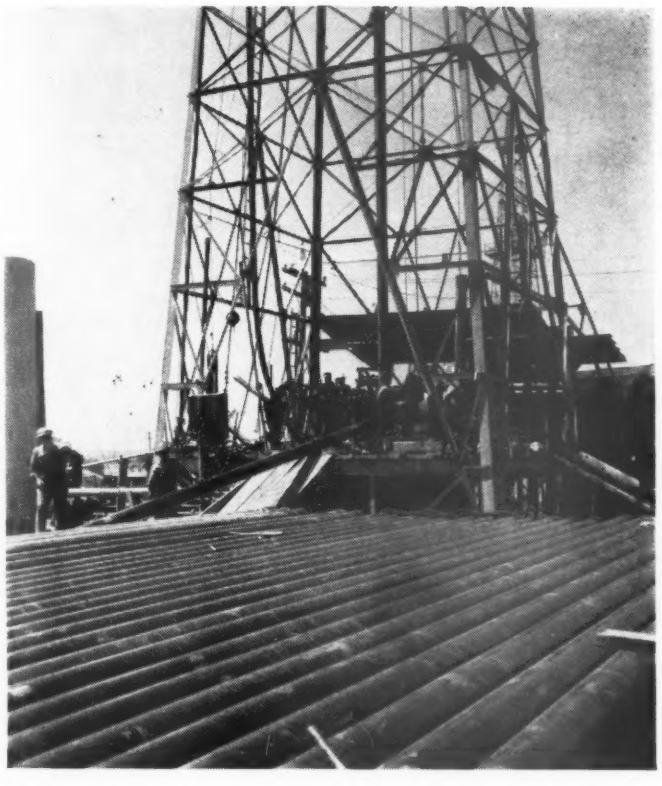


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Table 3. Summary of economics of cycling for hypothetical reservoir.

	I Cycling at original reservoir pressure of 2960 psia		II Cycling at intermediate reservoir pressure of 1310 psia		III Cycling at reservoir pressure of 400 psia	
Future price of products	a Constant	b Increasing	a Constant	b Increasing	a Constant	b Increasing
Condensate recovery:						
Millions of barrels	31.612	32.179	30.482	30.757	22.978	24.259
Per cent of original in place	82.00	83.47	79.07	79.78	59.61	62.93
Saleable gas production, MM cu ft	231.90	248.47	245.50	248.80	251.30	251.30
Gross income—millions of dollars	101.800	142.565	100.788	125.209	83.925	104.091
Costs—millions of dollars:						
Royalty at 1/6	16.967	23.761	16.978	20.868	13.988	17.348
Field investment	2.400	2.400	4.800	4.800	4.800	4.800
Field operation	1.346	1.640	1.809	1.908	1.192	1.588
Plant investment	5.500	5.500	5.300	5.300	4.800	4.800
Plant operation	16.910	22.485	16.395	20.626	10.380	13.655
Total excl. taxes	43.123	55.786	45.102	53.502	35.160	42.191
Operating profit—millions of dollars						
Before taxes	58.616	86.779	55.686	71.707	48.765	61.900
After ad valorem taxes at 8 per cent of net profit	53.927	79.837	51.231	65.970	44.864	56.948
Discounted at 4 per cent interest	36.018	48.756	38.910	48.350	37.294	46.450
Average discount factor	0.668	0.611	0.760	0.733	0.831	0.816
Final reservoir pressure, psia	480.0	300.0	400.0	350.0	400.0	400.0
Producing life, years	28.0	24.0	24.0	25.0	17.0	21.0

sure cycling but very close to the optimum size for intermediate and low pressure cycling. A plant of 120,000,000 cu ft per day capacity and 50 wells would increase the present worth profit of high pressure cycling from $36,000,000 to $39,500,000, which would slightly exceed the present worth profit for low pressure cycling and would be essentially equal to the profits for intermediate pressure cycling. The optimum sizes of plants were not determined for the cases of increasing future prices. For these cases the optimum plant sizes are a function of conflicting factors, namely the relationship and interest factor and price increase. If the effect of increasing price balanced the interest factors and other costs such as ad valorem taxes, the optimum plant size would be a function of relative ultimate recovery of products. Delaying of production to take advantage of increased prices may be a hazardous course because of the inability to predict future prices with much assurance, but in any cases, the particular economic position of the operators of the field will influence the de-

FIG. 10. Recovery curves of butane and heavier. Based on data from Standing, Lindblad & Parsons A.I.M.E. T.P. 2200.

Permeability variation = 0.55

75 per cent macroscopic coverage by injected gas

X RECOVERY OF BUTANES AND HEAVIER:

CASE I. Cycling at original reservoir pressure of 2960 p.s.i.a.

CASE II. Cycling at intermediate reservoir pressure of 1310 p.s.i.a.

CASE III. Cycling at reservoir pressure of 400 p.s.i.a.

a Denotes constant future price of products.

b Denotes increasing future price of products as given in Fig. 2.

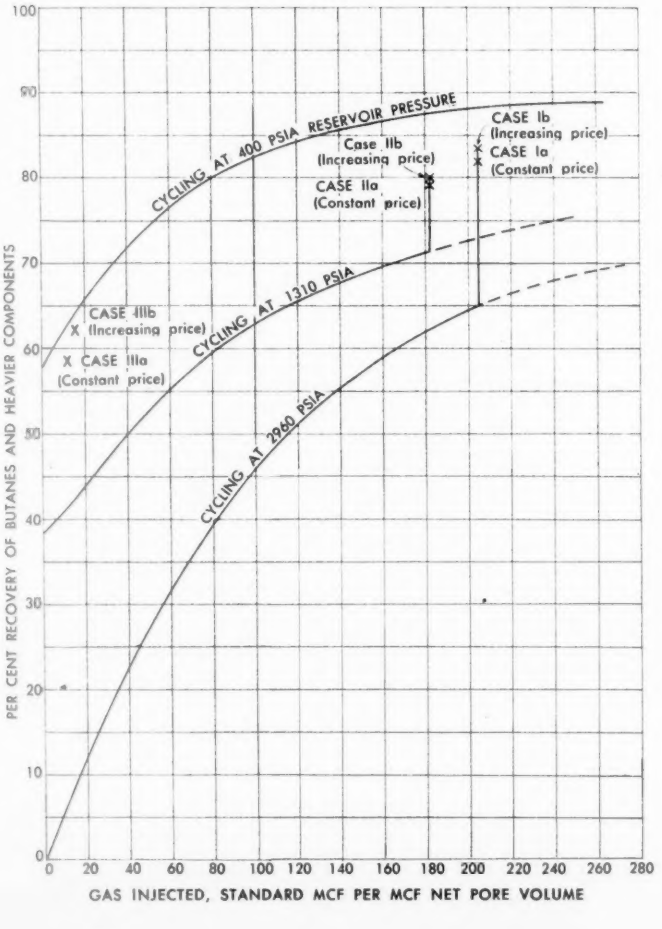

CYCLING AT 400 PSIA RESERVOIR PRESSURE
CASE Ib (Increasing price)
Case IIb (Increasing price)
CASE Ia (Constant price)
CASE IIa (Constant price)
CYCLING AT 1310 PSIA
CASE IIIb X (Increasing price)
X CASE IIIa (Constant price)
CYCLING AT 2960 PSIA
PER CENT RECOVERY OF BUTANES AND HEAVIER COMPONENTS
GAS INJECTED, STANDARD MCF PER MCF NET PORE VOLUME

FIG. 11. Cumulative present worth profits from a condensate field.

Profits converted to present worth at 4 per cent interest.

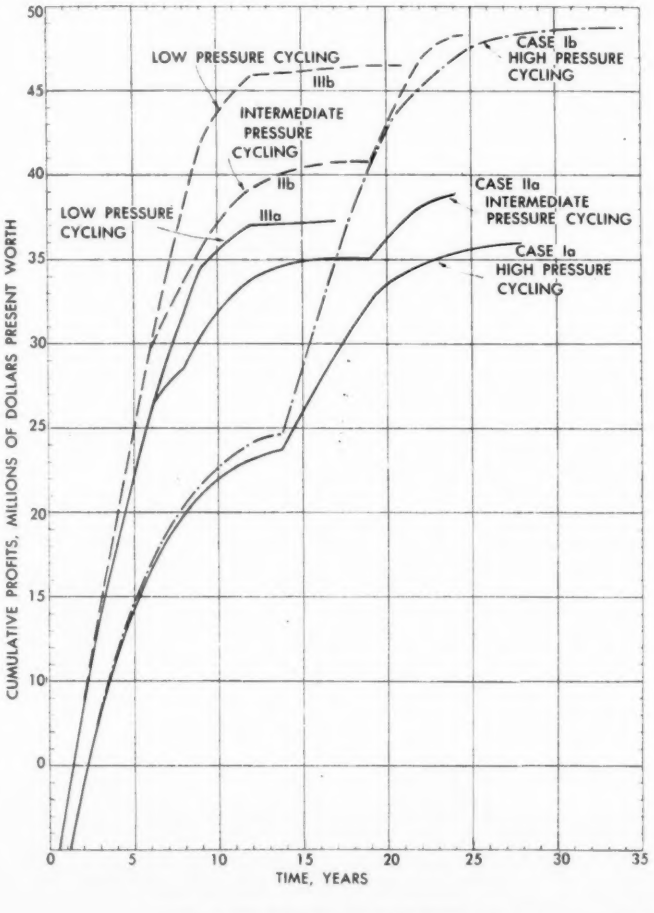
CASE I. Cycling at original reservoir pressure of 2960 p.s.i.a.

CASE II. Cycling at intermediate reservoir pressure of 1310 p.s.i.a.

CASE III. Cycling at reservoir pressure of 400 p.s.i.a.

a Denotes constant future price of products.

b Denotes increasing future price of products as given in Fig. 2.



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NEOPRENE

cision. For the case of declining future prices, the optimum profit would of course result from rapid depletion and sale of products.

● **Conclusions.** The most profitable method of production is dependent on a number of important factors and it is difficult to generalize the answer. Although recovery may be greater for one method of production than for another, the profits may not be commensurate with relative recovery. Some of the important factors are:

1. Field characteristics:
   - (a) Occurrence or absence of black oil.
   - (b) Size of reserves of products.
   - (c) Properties and composition of of reservoir hydrocarbons.
   - (d) Productivity of wells.
   - (e) Permeability variation, which controls the degree of bypassing of injected gas.
   - (f) Degree of natural water drive existing.
   - (g) Field development and operating costs.
   - (h) Plant installation and operating costs.
2. The market demand for gas and liquid petroleum products.
3. Future relative value of the products.
4. Rate of interest to convert future profits to present worth.
5. Existence or absence of competitive producing conditions between operators.
6. Taxes, both ad valorem and income.

● **Acknowledgments.** The author is grateful to the management of the Union Oil Company for permission to publish this paper and to those who have assisted in its preparation, particularly to R. H. Smith of The Signal Oil Company for calculating the reservoir performance in the depletion period following cycling, to B. B. Kuist and T. Weaver of Fluor Corporation for estimating the plant costs and to N. B. Clark of Union Oil Company of California for assistance in much of the analysis.

● **Nomenclature.**

R_p = flowing gas-oil ratio, std cu ft/bbl tank oil.

K_g = relative permeability of reservoir to gas, millidarcys.

K_o = relative permeability of reservoir to oil, milladarcys.

U_o = viscosity of liquid hydrocarbons at reservoir conditions, centipoises,

U_g = viscosity of gas at reservoir conditions, centipoises,

B = oil formation volume factor—volume at reservoir conditions/volume at standard conditions.

Y = relative gas density—std volume of gas/volume at reservoir conditions,

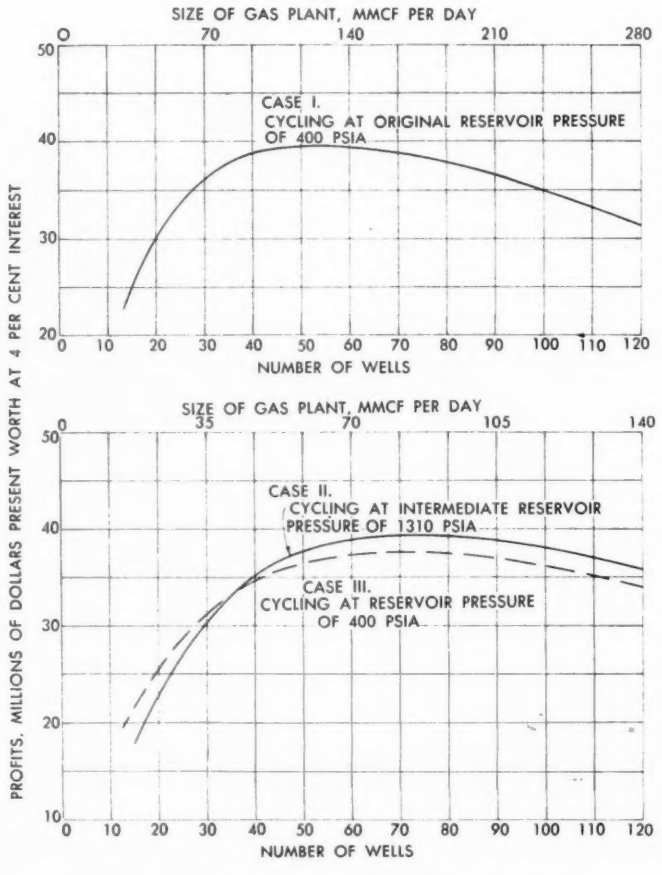

FIG. 12. Economics of well spacing for condensate field. Constant price of product.

Q = rate of gas flow, std cu ft/day,

h = productive zone thickness, ft.

P_e = pressure at drainage radius, psia,

P_w = pressure at well bore sand face,

P_b = pressure base, 14.73 psia.

r_e = drainage radius, ft.

r_w = well bore radius, ft.

● **References.**

1. "Primary Pressure Control—Will It Increase Recovery?" T. H. Acres, AIME, Los Angeles, 1942.
2. "A Method for Evaluating Pressure Maintenance," N. van Wingen, *AIME T. P. 1665, Petroleum Technology*, January 1944.
3. Unpublished lecture delivered at Los Angeles, E. C. Babson.
4. "The Calculated Effect of Pressure Maintenance on Oil Recovery," R. L. Hoss, *AIME T. P. 2231, Petroleum Technology*, September 1947.
5. "Evaluation of Pressure Maintenance by Internal Gas Injection in Volumetrically Controlled Reservoirs," E. C. Patton, Jr., *AIME T. P. 2098, Petroleum Development & Technology 1947, Trans.* Vol. 170.
6. "Steady Flow of Gas-Oil-Water Mixtures Through Unconsolidated Sands," M. C. Leverett and W. B. Lewis, *AIME T. P. 1206, Petroleum Development & Technology 1941, Trans.* Vol. 142.
7. "Formation Volume and Viscosity Studies for Dominguez Field," B. H. Sage and W. N. Lacey, *API Drilling and Production Practice*, 1935.
8. "Some Factors in the Economics of Recycling," Emby Kaye, *AIME T. P. 1304, Petroleum Development and Technology, 1942, Trans.* Vol. 146.
9. "Performance of Distillate Reservoirs in Gas Cycling," W. Hurst and A. F. van Everdingen, *AIME T. P., 1969, Petroleum Development and Technology, 1946, Trans.* Vol. 165.
10. "Calculated Recoveries by Cycling from a Retrograde Reservoir of Variable Permeability," M. B. Standing, E. N. Lindblad, and R. L. Parsons, *AIME T. P. 2200, Petroleum Technology*, May, 1947.
11. "Cycling at High Pressure vs. Depletion and Cycling at Low Pressures," E. O. Bennett, *California Oil World*, Second Issue, October 1947 Vol. 40, No. 20.
12. "Evaluation of Gas Condensate Reservoir for Cycling," Wm. H. Justice, AIME, New York 1947.
13. "Texas Gas for California, A. F. Bridge, *Oil and Gas Journal*, September 21, 1946, Vol. 45, No. 20.
14. "Some Theoretical Aspects of Well Drainage and Economic Ultimate Recovery, Vaughn Moyer, *AIME T. P. 2201, Petroleum Technology*, May 1947.
15. "Back-Pressure Data on Natural-Gas Wells and Their Application to Production Practices," E. R. Rawlins and M. A. Schellhardt, *U. S. Bureau of Mines, Monograph 7.*
16. "Financial Analysis of Thirty Oil Companies," Pogue and Conqueron, The Chase National Bank of the City of New York, November, 1945.
17. "Practical Aspects of Cycling," M. G. Miller and M. R. Lents, *Oil & Gas Journal*, March 11, 1948.

★ ★ ★

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(Left) Twin Disc Model P-214 mounted on the jackshaft.

(Extreme Left) Twin Disc Model P Air-actuated Clutch.

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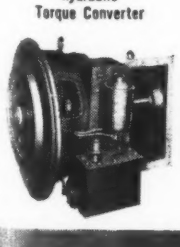
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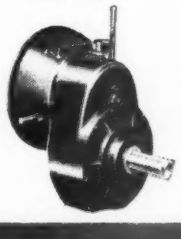
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Calculation of Pumping Unit Engine Drives

By ED CARAWAY*

FORMULAS for arriving at engine speed, engine sheave diam, strokes per min pumping speed, ratio of gears, or diam of sheave on gear reducer are familiar to most engineers and operators. We are questioned occasionally, however, by those who are not familiar with this phase of production and need to solve a particular problem.

One of the most common needs is to calculate the required pitch diameter of the engine sheave when the following information is available:

Pumping speed (strokes per min, or spm), ratio of gears, diam of unit sheave, engine speed (revolutions per min, or rpm).

Formula:

$$\frac{\text{spm} \times \text{gear ratio} \times \text{unit sheave diam}}{\text{engine rpm}} = \text{diam engine sheave} \quad \ldots \quad (1)$$

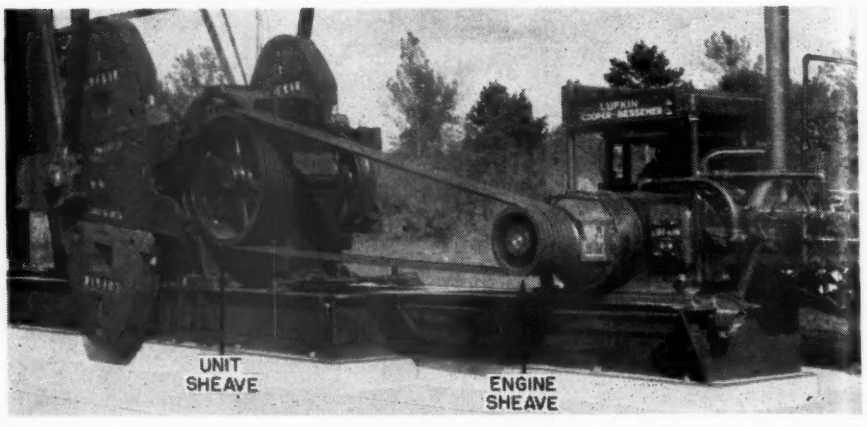
However, if all the factors are known except engine speed (but including the diam of the engine sheave), change the formula as follows:

$$\frac{\text{spm} \times \text{gear ratio} \times \text{diam unit sheave}}{\text{diam engine sheave}} = \text{engine rpm} \quad \ldots \quad (2)$$

This formula (2) is useful for pumping installations in operation when the engine speed is desired. All of the information is available from the equipment on hand and the engine speed can be calculated readily when no tachometer is available to measure the rpm of engine. Examples of the two formulas are shown below:

Given:

strokes per min (spm)	= 20
ratio of gear reducer	= 30 to 1
diam of unit sheave	= 30 in.
engine speed (rpm)	= 900



Twin crank pumping unit with gas engine.

(1) $$\frac{20 \text{ (spm)} \times 30 \text{ (gear ratio)} \times 30 \text{ (unit sheave)}}{900 \text{ (engine rpm)}} = 20 \text{ in. (diameter engine sheave)}$$

or

(2) $$\frac{20 \text{ (spm)} \times 30 \text{ (gear ratio)} \times 30 \text{ (unit sheave)}}{20 \text{ (engine sheave)}} = 900 \text{ (engine rpm)}$$

Likewise, if all information is available except the diam of the unit sheave, the formula should be:

$$\frac{\text{engine rpm} \times \text{diam engine sheave}}{\text{spm} \times \text{gear ratio}} = \text{diam unit sheave} \quad \ldots \quad (3)$$

If strokes per min is required:

$$\frac{\text{engine rpm} \times \text{diam engine sheave}}{\text{gear ratio} \times \text{diam unit sheave}} = \text{spm (pumping speed)} \quad \ldots \quad (4)$$

If gear ratio is required:

$$\frac{\text{engine rpm} \times \text{diam engine sheave}}{\text{spm} \times \text{diam unit sheave}} = \text{ratio of gears} \quad \ldots \quad (5)$$

The P.D., or pitch diam, of the sheaves on the engine and the unit is the diam usually used in calculating drives, however, either the OD (outside diam) or P.D. may be used to get equally accurate results, if it is remembered that you are either working from P.D. or OD and do not combine one sheave figured on pitch diam and another figured on outside or overall diam. This would give a difference of approximately $\frac{3}{4}$ in. between OD and P.D. on "C" section V-belt drives with, of course, more difference on the "D" or "E" section and less difference on "A" or "B" section belts.

In planning a drive it would be necessary to figure belt speeds and the horsepower that each belt would transmit. Since this is done when the unit is designed and the proper size and number of belts are furnished commensurate with the capacity of the gears, we will not describe that calculation. In most cases the same number and size of belts as originally furnished with the unit will be continued.

"C" section V-belts seem to be the most popular for oil field pumping use. These are $\frac{7}{8}$ in. wide across the top and $\frac{5}{8}$ in. deep. "D" section V-belts, which are $1\frac{1}{4}$ in. wide across the top and $\frac{3}{4}$ in. deep, are used more commonly with slower speed engines or for the heavier loads. "B" sections are used where small P.D. sheaves are necessary or when loads are light. The larger "E" section belts or the light "A" section are seldom used for oil-field drives.

Often convenient is the formula for arriving at the relation of sizes of the unit sheave and the engine sheave; in other words, whether the size comparison between the two sheaves should be 1 to 1, calling for 12-in. engine and 12-in. unit sheave or the ratio would be 2 to 1 calling for 24-in. unit sheave to 12-in. engine sheave, 20-in. unit sheave to 10-in. engine sheave, or some similar relation:

$$\frac{\text{spm} \times \text{gear ratio}}{\text{engine rpm}} = \text{relation of sheave sizes} \quad \ldots \quad (6)$$

Example:

(6) $$\frac{20 \text{ (spm)} \times 30 \text{ (gear ratio)}}{900 \text{ (engine rpm)}} = \frac{2}{3} \text{ relation}$$

This would allow a 20-in. engine sheave to a 30-in. unit sheave, or a 10-in. engine sheave to a 15-in. unit sheave, or 16-in. engine to 24-in. unit. For selecting the sizes most readily available and most economical, this relation of the engine sheave to the unit sheave is convenient to know. ★ ★

*Division Manager, Lufkin Foundry & Machine Company.

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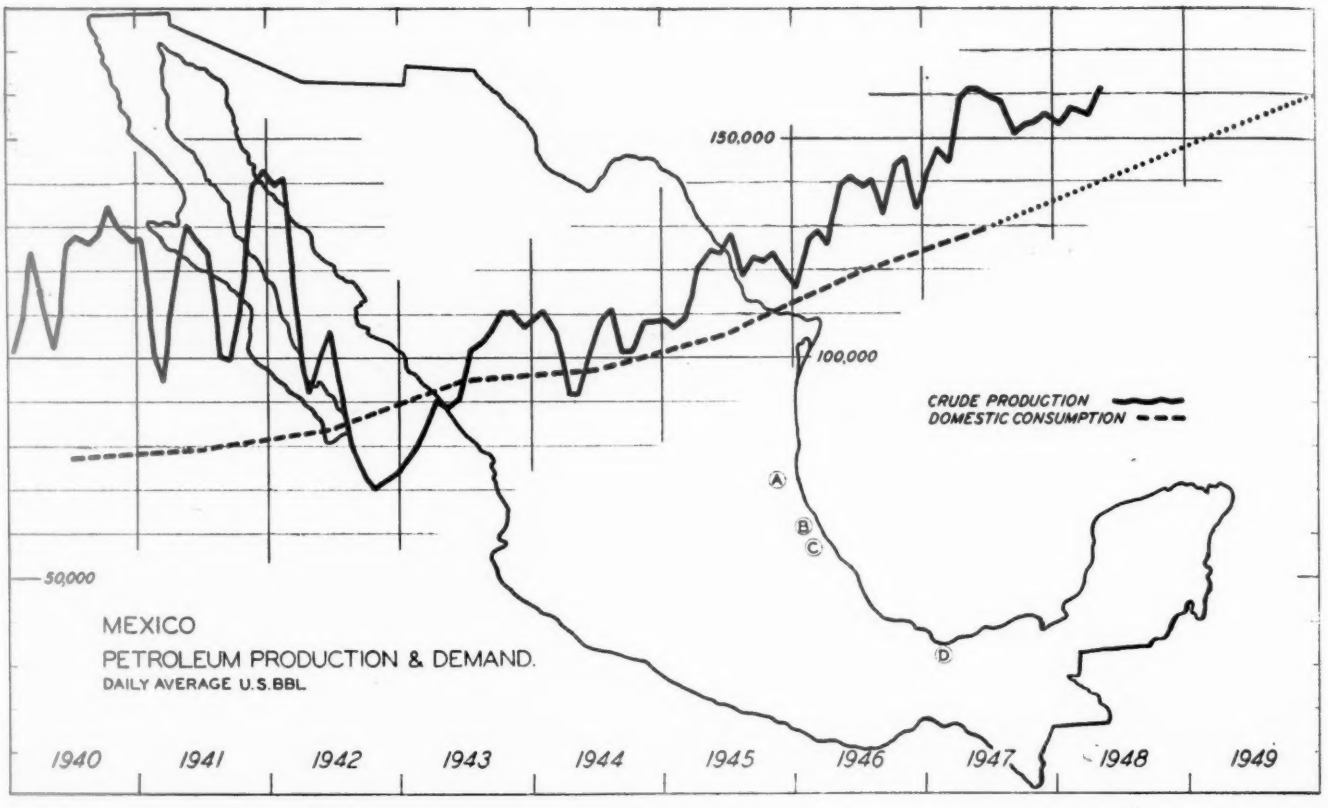

FIG. 1. A Northern fields, B Southern, C Poza Rica, and D Isthmus fields.

Mexican Oil Increase Due to Poza Rica Field

By JOHN J. SLATTERY

MEXICO's crude oil production, see Fig. 1, has shown a steady yearly increase the last five years. Production in 1948, which averaged 156,000 bbl per day for the first five months of the year, is expected to average 160,000 bbl per day for the full year. This will be the highest production of crude in Mexico since 1937, when production was about 170,000 bbl.

A steadily increasing rate of production such as this might indicate that the petroleum industry of Mexico was in a satisfactory position. An analysis of the situation, however, reveals some precarious features. Crude production in 1948 is being obtained from the same sources as the production of 1937. Only one field, Poza Rica, is producing more oil per day now than it was producing in 1937. The inherent dangers of this situation can be understood by the four fields now producing in Mexico. The location of these fields is shown by A, B, C, and D on the outline map in Fig. 1. The three principal fields can seen in further detail on the map in Fig. 2.

▸ **"A"—The Northern Fields.** First developed in the early 1900's, this area is some 30 miles west of Tampico on the Gulf Coast, about 250 miles south of Brownsville, Texas. The producing formation consists of a broad gentle anticline of Middle Cretaceous limestone (roughly equivalent to the Buda-Del Rio-Georgetown Edwards limestones of Texas) of a definitely non-porous limestone with oil accumulations in the fractured zones. The regional dip is to the South. Wells average about 2200 ft deep and some 4400 wells have been drilled in the area; of these about 1650 were producers. Total production to the end of 1947 was 793,000,000 bbl and the field produced 10,038,000 bbl during 1947. The area totals about 465,000 acres, but owing to the irregularity of the accumulation the actual drilled area is only about 35,000 acres.

This field is believed to be in the last stages of depletion. Some 550 wells are now producing about 27,000 bbl per day and little can be expected from this area but a minimum decline of about 10 per cent per year. Producing from fractured limestone with a strong salt water drive, rehabilitation methods such as practiced in the United States, are assumed to be out of the question.

▸ **"B"—The Southern Fields.** First developed in about 1910, this area is about 60 miles south of the Northern Fields. The producing formation consists of a coral reef phase of the same Middle Cretaceous limestone that produces in the Northern Fields, with a gently sloping east flank and a sharply faulted west flank, the whole in the form of a crescent as shown on the map Fig. 2. The limestone is of a porous, even cavernous texture. Production is found on the crest of the structure and some of the world's greatest oil wells were brought in here. One example should suffice: Cerro Azul No. 4 came in February, 1916, from a total depth of only 1752 (minus 1351 ft subsea) at about 250,000 bbl per day. This well is still producing close

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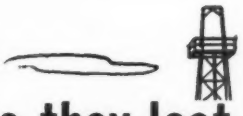

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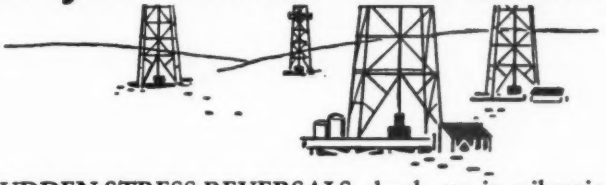

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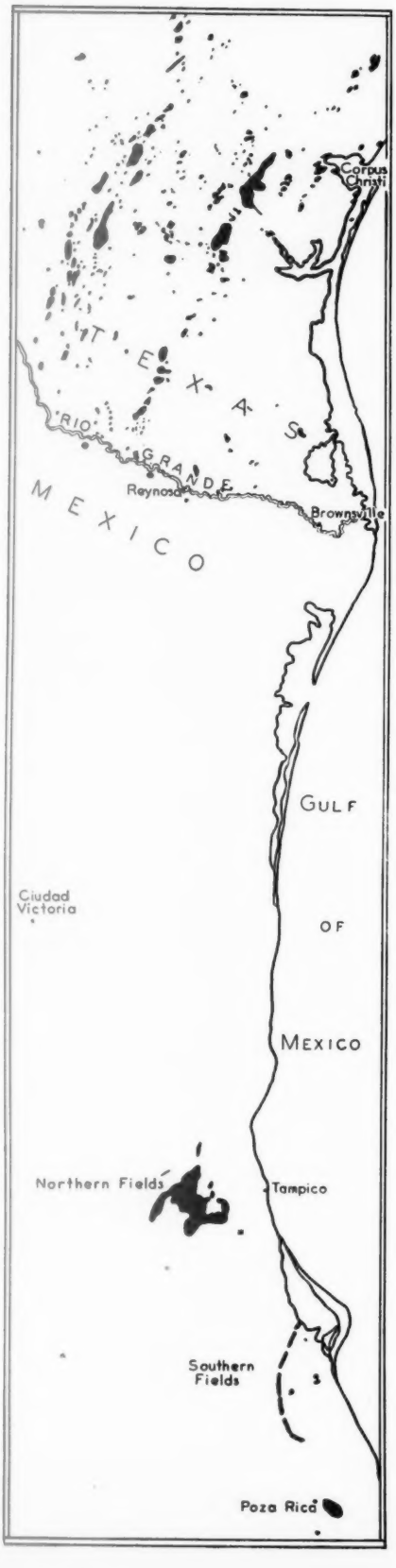
FIG. 2. The three principal Mexican fields are shown along the Gulf Coast line. Note the barrier presented by the Rio Grande to oil fields. The new Reynosa discovery is an exception.



to 2000 bbl per day after having produced some 95,000,000 bbl of oil. Total production of the area to the end of 1947 was 1,078,000,000 bbl of oil; the field produced 7,821,000 bbl during 1947.

This field is also believed to be in the last stages of depletion. Some 200 wells are still producing, out of a total of 571 producers brought in. A total of 1320 wells were drilled in the area. A strong salt water drive moves the oil and, as in the Northern Field, rehabilitation is assumed to be futile. It may be worth noting that there is not a single pumping well in the whole Northern, Southern, and Poza Rica fields of Mexico.

This field is being produced to capacity at 21,000 bbl per day. Salt water encroachment could rapidly occur; production must, therefore, be very carefully controlled. The field has declined at the rate of about ten per cent per year and nothing further can be expected from this area.

▸ **"C"—Poza Rica**—This field is about 30 miles south of and on the same trend as the old "Golden Lane" or Southern Fields of Mexico. The producing structure, about minus 650 ft subsea, is an anticline in the same Middle Cretaceous limestone, here combining both phases of the other two fields: that is, the lime is non-porous at the top and gradually increases in porosity with depth. First discovered by Shell in 1930, the producing area covers no more than 12,500 acres. About 100 wells have been drilled on the structure to date and all were producers or defective holes. At this writing, some 65 wells are producing close to 100,000 bbl per day—a rate of production per day per well that is stupendous compared with that in the United States.

Obviously, this field is the backbone of Mexican crude oil production. Total production to the end of 1947 was 294,000,000 bbl and the field produced 32,000,000 bbl during 1947. As shown on the column to the right, Fig. 3, this field has averaged 92,000 bbl per day for the first five months of 1948, and will probably be produced at close to 100,000 bbl per day for the rest of the year.

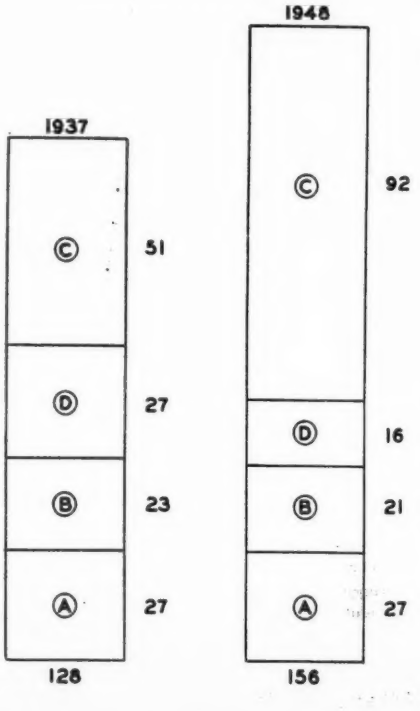
▸ **"D"—The Isthmus Fields.** Situated in the northern section of Mexico's Isthmus of Tehuantepec, production in this area is obtained from a number of fields in the saline basin, that is, from sands adjacent to salt domes. Highly rated as a petroleum producing area, actually, this region is rather disappointing. First operated about 1900, some 14 small fields have produced a total of only 150,000,000 bbl to date. Production in 1947 was 6,400,000 bbl and about 250 wells (out of some 400 producers completed from 750 wells drilled) are now making about 16,000 bbl per day. Past experience indicates that this area may also decline steadily.

Here then, is the Mexican crude production picture: Three old fields, on their last legs, so to speak, and one new area, whose capacity to produce is not definitely known, are each being produced at their estimated full potential. The rate of production of the three old fields is assumed to be a foregone conclusion. Poza Rica may stand up under a withdrawal of 100,000 bbl per day, or it may not.

This picture is no secret to Pemex administrators and technicians. A glance at the projected domestic consumption line in Fig. 1, however, makes it plain that Pemex must carry on at this rate. Conservative practice would certainly warrant handling Poza Rica with the utmost care. At the same time, Pemex must make every effort to meet this domestic demand and Poza Rica is the only possible immediate source, at present, of increasing crude production.

These are economic factors that enter into the picture. Oil is now selling for the highest prices in history in the world markets. Every barrel exported from Mexico means real dollars on the barrel head for Pemex. Yet, Pemex's largest customer is the National Railroads of Mexico — and Pemex has a long standing contract to sell fuel (now about 15,000,000 bbl per year) for the price of 4.85

FIG. 3. Production of main areas in Mexico in 1937 and 1948.



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pesos per bbl, which is the equivalent of $1.00 U. S. at the old rate of exchange of 4.85 to 1.00. But the exchange rate broke on July 22nd of this year and, at this writing, the peso is valued at about 7.00 to 1.00. Consider what this means: Pemex can export a barrel of fuel oil for say $3.00 per bbl—and these dollars can be applied to meet Pemex's dollar expenses—or they can be converted into pesos at 7 to 1—roughly 21.00 pesos per bbl. Or, Pemex can continue supplying the railroads of Mexico with fuel at 4.85 pesos per bbl. (About $0.70 U. S. currency.)

To raise prices would completely disrupt the already strained economy of Mexico. But dollars must be found for dollar expenses, thus Pemex must export every available barrel of crude or products.

Should Poza Rica not be able to stand the withdrawal of 100,000 bbl per day and encroachment of salt water occurs suddenly, cutting Poza Rica's production to say about 50,000 bbl per day, it would be a blow in the face of the rising domestic demand and the necessity of exporting every available barrel. This is the inherent danger of the present situation.

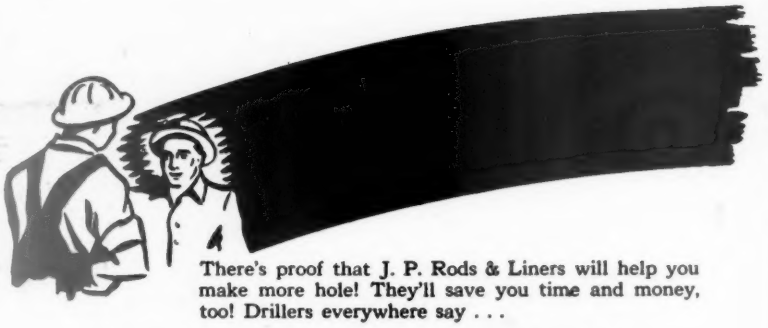
Reserves—Proved oil reserves, at the end of 1947, is estimated at about 920,000,000 bbl. The bulk of this oil is in the Poza Rica field, where an estimated total recovery of 1,000,000,000 bbl—294,000,000 bbl having been produced to date — leaves an estimated 706,000,000 bbl in the ground. The remainder of the proved reserves, 214,000,000 bbl, roughly is equally divided among the other three fields.

Possible future reserves—Of Mexico's total land area, surely one-third can be called possibly petroliferous. Estimates of possible reserves range from 10 to 100 billions of barrels and even this latter figure may be too low. Detailed discussion of these areas would take volumes, but one example will serve to demonstrate what Mexico's potential petroleum possibilties are. The map, Fig. 2, shows the fields now producing in south Texas, and the stretch of land in Mexico between these Texas fields and the Northern Fields of Mexico. There is every reason to expect a duplication of the Texas fields when drilling south of the border is undertaken.

Consider that a total of only about 7000 wells have been drilled in the whole of Mexico, and that about 6500 of these were drilled in the existing fields, the rest drilled elsewhere. This is just scratching the surface, so far as finding oil is concerned. In this potentially petroliferous area shown on this map there is room for thousands of exploratory wells with an almost certain discovery of enormous oil reserves. The only thing that is needed to put some wells down.

Briefly, Mexico is trying to find these reserves with her own capital, through her own petroleum company "Pemex." Foreign capital cannot invest in the petroleum industry of Mexico under the present laws. Pemex is exploring and drilling wildcat wells in a number of places, and may find field or fields tomorrow. But the very volume of the effort required is disheartening for any one organization. It is not unreasonable to state that the proper development of Mexico's petroleum reserves should require the drilling of thousands of wells per year and Pemex simply lacks the funds for such an effort.

The rapidly approaching confluence of the graphs of Mexico's crude production and domestic demand demonstrated the necessity of finding new production. The effect on Mexican economy if Mexico were in a position to export millions of barrels of oil today is obvious. How and when these results will be achieved is a question for the future and Mexico will make her own decisions. ***



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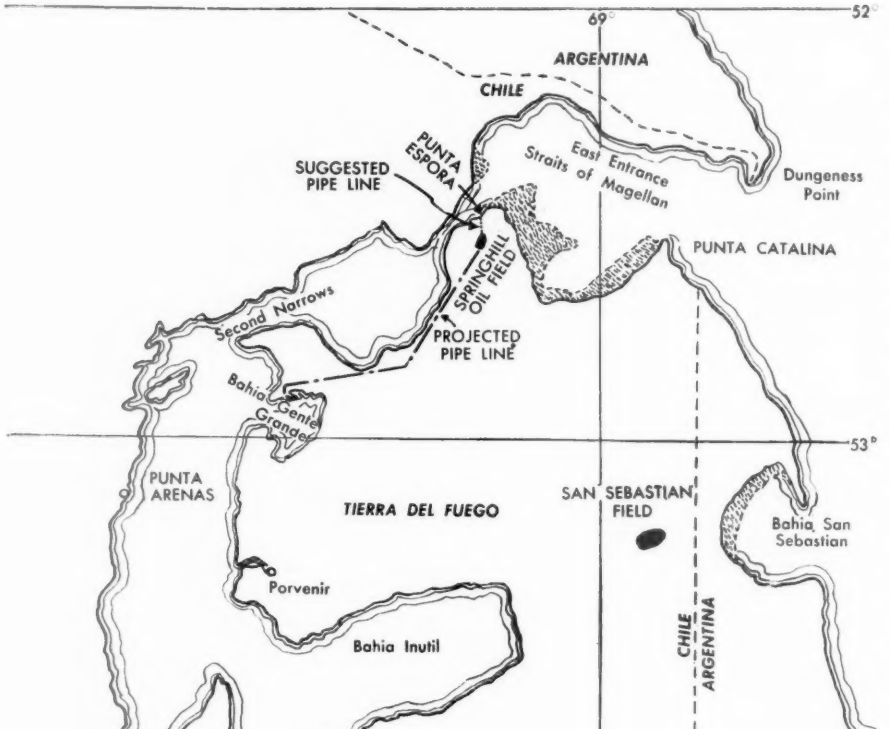

FIG. 1. Map of Tierra del Fuego showing Springhill and San Sebastian oil fields.

Pipe Line Problems Affect Chile's Oil Development

By GLEN M. RUBY, Hoover, Curtice & Ruby

THE world's farthest south oil producing area, Tierra del Fuego, south of the Straits of Magellan, presents some tough transportation problems and the answers are not in the books, which makes it all the harder for the orthodox engineer who is usually lacking in imagination, to find a ready solution.

That part of Tierra del Fuego which belongs to Argentina and which will no doubt be oil-bearing does not have the same problems, in that the Argentine coast is the sheltered coast and tankers can load almost any place. The Bay of San Sebastian, on the Atlantic coast, while shallow, can be dredged and made into an excellent port. It is only a few miles from Chilean territory, but it is not likely that Argentina will permit her neighbor to run any oil across Argentine soil. A few years ago, when Argentina found a workable vein of coal, along the Chilean border a few miles from Natales, an excellent port on one of the inlets from the Pacific, Chile refused to permit her neighbor to construct and operate a railway for bringing the coal to the docks.

The prevailing, strong westerly winds in this part of the world make shelter a necessity. The large body of water which indents the Chilean part of Tierra del Fuego and extends well into what will probably be producing territory, known as Bahia Inutil (Useless Bay) is just that. The early English explorers who mapped and named the various coast line features recognized the bay for what it is, so far as shelter is concerned. However, by building a break water from the north shore of the bay, near the east end, a good berth can be made for fair sized vessels, and can serve the immediate territory.

At the present time the engineers of Corporación de Fomento, who are endeavoring to work out these transportation problems, are planning to use Bahia Gente Grande, the Bay of the Big People, as a pipe line terminus and harbor. It is so shallow that it must be dredged in places and either a long pier must be built or tankers must load from a hose and line laid about a mile off the north shore of the bay. While it is probable that oil will be found nearer to Bahia Gente Grande than the present Springhill Field, nevertheless every mile that this oil must be piped greatly increases the difficulty of getting through a line an oil which is practically a jelly at even summer soil temperatures. To heat the oil will be very expensive, and if it is ever allowed to stop in the line, and this is almost a certainty if it behaves like other pipe lines, it will mean digging up the entire line.

The projected line from Springhill to Bahia Gente Grande is about fifty miles in length. If it is necessary to use this bay as a port it is probable that partial refining wil be the answer to producing a pipe line oil. This port, being inside the Second Narrows does not have the excessive tides found at the entrance to the First Narrows and along the South Atlantic coast. Within the Straits proper the range of average tides is only about ten feet. This makes for more simple dock facilities, and Bahia Gente Grande being much closer to Punta Arenas, the principal shipping point, would make a satisfactory harbor for small boats to transhipp equipment from boats which could unload ocean cargo on the Punta Arenas docks.

This writer, who conducted the exploration program which resulted in the discovery of both the Springhill field and the new "find" at San Sebastian, recommended utilizing two favorable, natural factors to simplify and facilitate the immediate marketing of oil from Springhill. He recommended

to the Chilean petroleum and pipe line engineers that they lay a line from Springhill to Punta Espora, some five miles away, at the eastern entrance to the Straits of Magellan. Here, the tides average over forty feet, between the mean high and low points, and an artificial basin could be constructed which could be entered at the turn of the high tide, twice daily, and tankers or cargo vessels could leave at the same time.

Approximately a million yards of earth would have to be moved by drag line. Probably no blasting would be necessary as it is all glacial drift and the largest boulder would readily be handled by average dredging equipment. Along the Straits this glacial drift shows an assortment of clay, sand, gravel, and various sized boulders, the average of which is about four inches in diameter. None attains the size of a cubic yard.

The plan of construction recommended was to make a preliminary excavation along the low coast line, parallel to it and inland about one hundred feet. This would be to a depth equal to mean low tide. In the bottom of this trench would be poured a concrete slab 30 inches thick and, say, twenty feet wide and the length of the trench, some 600 feet. The very little water encountered in water wells which penetrate the drift in search of stock water indicates that very little pumping would be required to keep the trenches dry.

The concrete for piers to which ships could be tied and to serve, also, to protect the sides of the vessels, could be poured in the same manner. When the concrete is in place, the basin can then be excavated by conventional methods.

The depth of the excavation should be approximately 30 feet below low tide, or enough to accommodate medium sized tankers. It does not appear practicable to risk large tankers in the canals along the west coast route to central and northern Chile.

The accompanying sketches indicate the size and shape of the basin. By excavating thirty feet below the low tide level of the slab, or dike, sufficient water is retained to float the loaded tanker or cargo vessel, which can only leave at high tide.

The funnel shaped entrance is necessary to handle safely slow-moving vessels where variable currents exist in the channel. When the tide is about half way between high and low, the current in the First Narrows is about twelve knots in the center of the channel, so that only at the turn of the tide is it safe to attempt to dock. However, Chilean pilots are among the best in the world and have the experience necessary for this type of navigation.

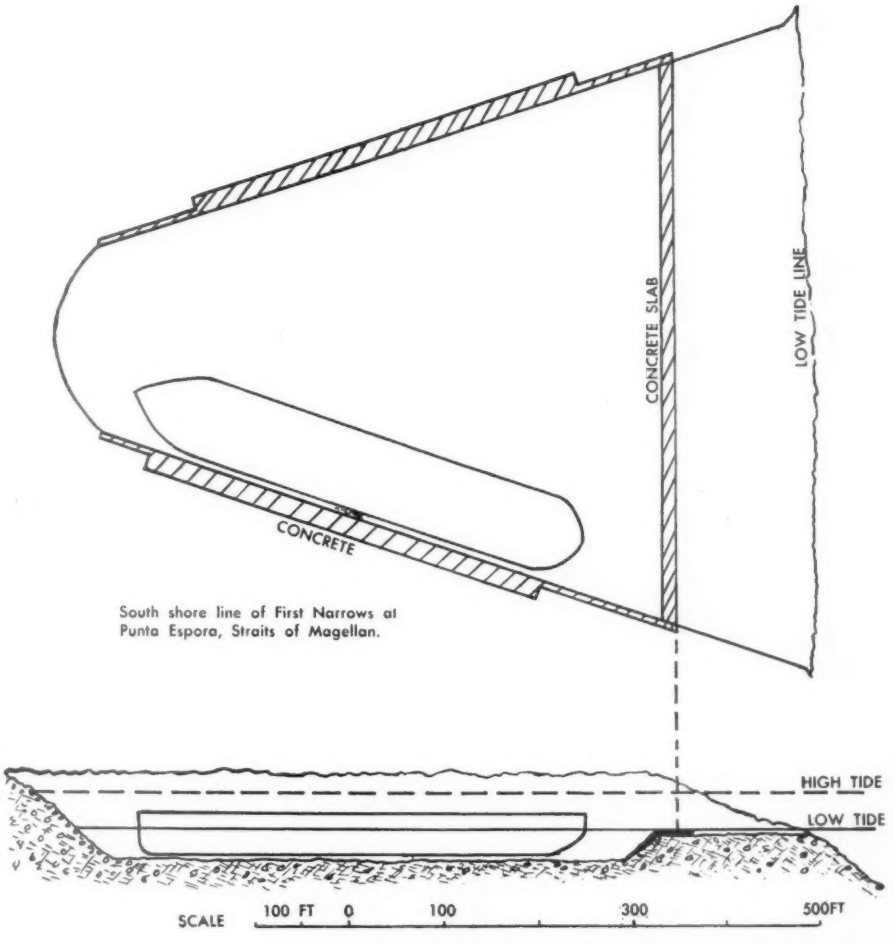

FIG. 2. Plan and cross-section of suggested ship basin at Punta Espora, Chile.

The second natural factor which could be utilized at Punta Espora in a five mile pipe line, is the hot, artesian water which the discovery, and subsequent wells, encountered at about 1600 feet. The temperature is about 100 F and the pressure is about 3 atmospheres. In fact, only by using heavy mud can the water be prevented from breaking in, as it did in the first well, where it flowed 1000 gal per min.

However, this water was being permitted to flow between strings of casing, in order to reduce its pressure and facilitate drilling through the sand. At the time, this waste of heat was condemned as unnecessary and it was suggested that it be utilized to heat oil for pipe line transportation. In fact, the suggestion was made to lay a water line in the same trench with the oil line proposed for Punta Espora, so that the oil would remain liquid at all times. In the writer's opinion, this waste of hot water will cost the Chilean Government a very considerable amount of money.

For a longer line; one necessary to transport oil from San Sebastian to the coast, it is doubtful if water at this temperature would suffice, but it would save in considerable degree burning oil and gas for this purpose. This writer does not know if the same hot water horizon is present in the recently drilled discovery well at San Sebastian, or if it will prove to be a field. Unfortunately, the producing sands, while having excellent porosity and permeability, are rather low pressure, considering the depth. Mud enters the sands while they are being drilled and it is probable that the method of completion of the San Sebastian well is responsible for its failure to show up well. Although a competent sand, casing was set through it and gun perforated. In all probability the zone which was penetrated by cement was beyond the range of the perforating bullets. However, the presence of oil in this structure, sixty miles southeast of Springhill, and at somewhat lesser depth, is ample indication that Chile can produce enough oil to support her own needs and to provide a much needed valuable export. ★ ★ ★

INTERNATIONAL SCHOLARSHIPS IMPROVE TRADE RELATIONS

Worthington scholarships. Twenty-five students from opposite ends of the earth on October 1 began a six months' training program at Worthington Pump and Machinery Corporation's Harrison Works.

The International Student Training Program is part of Worthington's effort to create and maintain harmonious trade relations with foreign countries, and is open by invitation to those men from abroad who have special qualifications along mechanical or engineering lines.

S. Riley Williams, vice president in charge of foreign operations, says, "We recognize that the need for this interchange of technical ideas between the United States and foreign countries is greater now than ever before. A closer understanding is becoming more and more possible by the interchange of technical students, helpful, not only to those who come here for training and through what they learn about American industry, but also through what we learn from them about their countries and about their people."

The students will spend three months at Harrison, for complete training on pumping equipment, condensers, feedwater heaters, and water-softening equipment. Then two months at Buffalo Works, for training on diesel and gas engines, compressors, and power transmission equipment. Upon completion of their study at Buffalo, they proceed to Wellsville, New York, and Holyoke, Massachusetts, for study of steam turbines, portable compressors, rock drill equipment, as well as air-conditioning and refrigeration equipment.

Wherever possible, one-day trips will be arranged to other industrial plants located in the vicinity of the Worthington Works, in order that the students may view equipment in actual field operations. A trip is also made to the Ransome Machinery Company, a Worthington subsidiary, at Dunellen, New Jersey, to study concrete mixers and pavers.

At the conclusion of the six months' period, one additional month is devoted to those products for which the student may show a particular aptitude, or which may be of particular importance to the conditions in the student's individual country. Upon satisfactory completion of his course of study, each student is awarded a certificate.

Among the countries represented are Uruguay, China, Chile, Egypt, Cuba, Holland, Siam, France, Mexico, and Canada.

Matthes Foundation. Two $1000 fellowships for one year of graduate work in engineering at the Carnegie Institute of Technology were awarded a Mexican and a Brazilian student by the Albert J. Matthes Foundation.

The fellowships, given annually to Latin Americans in the interest of continental friendship and unity, were officially presented to Paulo M. Vianno, Brazil, and Alfonso G. Bedoy, Jr., Mexico, by Dr. J. C. Warner, dean of graduate studies at Carnegie.

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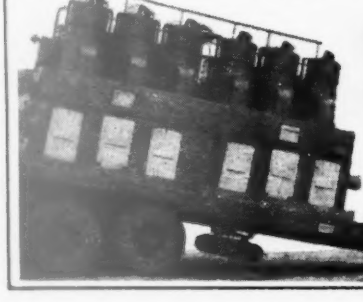

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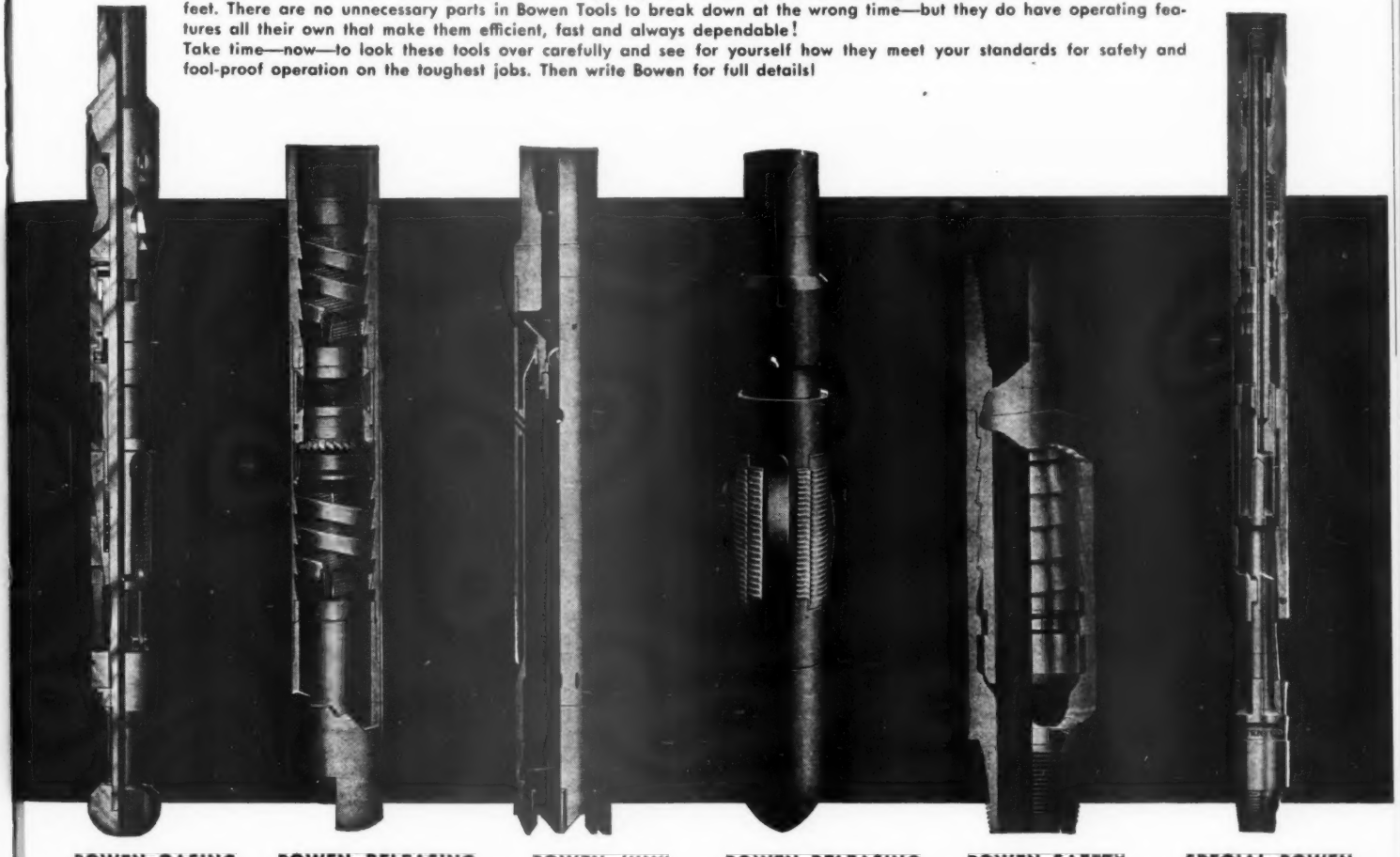

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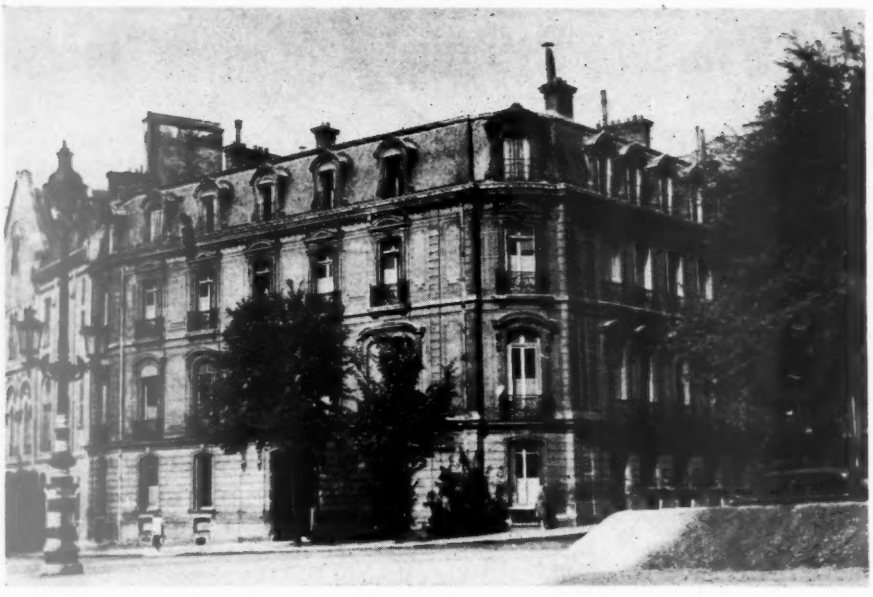

Home of the Institut du Petrole, Paris, France

Two Years in France

By EDWARD D. LYNTON

In the early part of 1946, the writer was invited to spend two years as oil consultant to the "Institut du Petrole" at 2, Rue de Lubeck, Paris, France. The Institute was formed in the latter part of 1945, as a part of the "Direction des Carburants et Lubrifiants" under the Minister of Industry and Commerce, to assist the French government-controlled oil companies in their overall activities and to supervise the training in all phases of the oil industry, of young Frenchmen who have the ambition to become oil men.

Besides the training program, the Institute acts as a consultant in almost every phase of the oil industry. The departments are headed by men who are specialists in their line of work. They are devoting all their time and energy to assisting the oil industry in France to regain its pre-war status and at the same time carrying on an extensive research program. The results of the research work at the Institute is published monthly in the "Revue de l'Institut Francais du Petrole, a publication entirely assembled and edited by the Institute.

The following organization list indicates the work carried on by the Institute and the heads of the departments: Mr. L. Jacque, director-general; Mr. R. Navarre, director; secretary-general, Mr. Fischer and Mr. Ducom; geology, Mr. Schneegans and Mme. Gubler; drilling and production, Mr. Nougaro; physical chemistry and refining synthetics, Mr. Jacque and Mr. Navarre; lubrication, Mr. Groff; motor fuels, Mr. Durier; library, Mr. Chapelle; economics, Mr. Guesdon; and materials, Mr. Daric.

In 1947 the Institute purchased a large property at Rueil-Malmaison in the suburbs of Paris. It was formerly a hospital, consisting of several buildings in spacious grounds. It was remodeled into class rooms, laboratories, library, and offices and is now the "Ecole Nationale Superieure du Petrole," into which has been concentrated all educational divisions formerly at Strasbourg, Toulouse, and Clermont-Ferrand.

The Institute's home is a three-story mansion, which once was one of the fine ducal residences of Paris. Some of the original panelling and paintings on the ceilings still remain. The ducal dining room is now the conference room, and the very large kitchen remodeled into an assembly room, large enough to show moving pictures to the members of the Institute. The writer's office used to be a luxurious bedroom, the secretaries being installed in the bathroom with all the fixtures removed.

Upon arriving at the Institute, the writer was impressed with its fine staff and the caliber of the men directing its operations. This was not only true of the Institute but also of the staff of the "Direction des Carburants" and all the men connected with the operations of the various French oil companies with whom he came in contact. The oil industry in France suffered almost complete anihilation during the six years of war. For example, out of 15 refineries with a capacity of some 165,000 bbl daily, only 3 refineries remained intact after the German retreat. At the end of 1947 the damaged refineries had gradually been rebuilt and replaced so that daily refining capacity reached about 110,000 bbl from 14 plants capable of complete or partial operation. One of the worst disasters was suffered by the privately owned Pechelbronn company with the destruction of its refinery in August 1944, by an American bombing raid in which some 1350 bombs were dropped in 12 minutes over an area of about 5 acres. A warning of the raid was broadcast so that everyone was able to take to the fields, with the Germans leading the way, and consequently there was little loss of life.

There is a general erroneous impression that the French are not working hard enough to rebuild their country. This may be true in some industries with which the writer is not familiar. One must remember that when a country has been occupied for some five years, denuded of machinery, farm implements, cattle and other physical assets, and beset with political confusion, a country cannot rise again to pre-war status very quickly. Much progress, however, has been made during the last two years. The coal mines have exceeded their pre-war production, the Pechelbronn oil fields are producing and refining 325,000 bbl per year or 70 per cent of their pre-war production, and the St. Marcet gas field, a 100 per cent government controlled company, is now producing some 20,000,000 cu ft of gas per day. In addition to the gas production, the Regie Autonome des Petroles (R.A.P.) has laid two 6-in. gas lines to Toulouse, 60 miles, and a 5-in. one to Tarbes and Pau. The Toulouse line is being extended to Bordeaux. An absorption plant is under construction at Boussens, near St. Gaudens, that will handle 40,000,00 cu ft of gas per day. This plant was designed and assembled for shipment overseas by Hudson Engineering Company of

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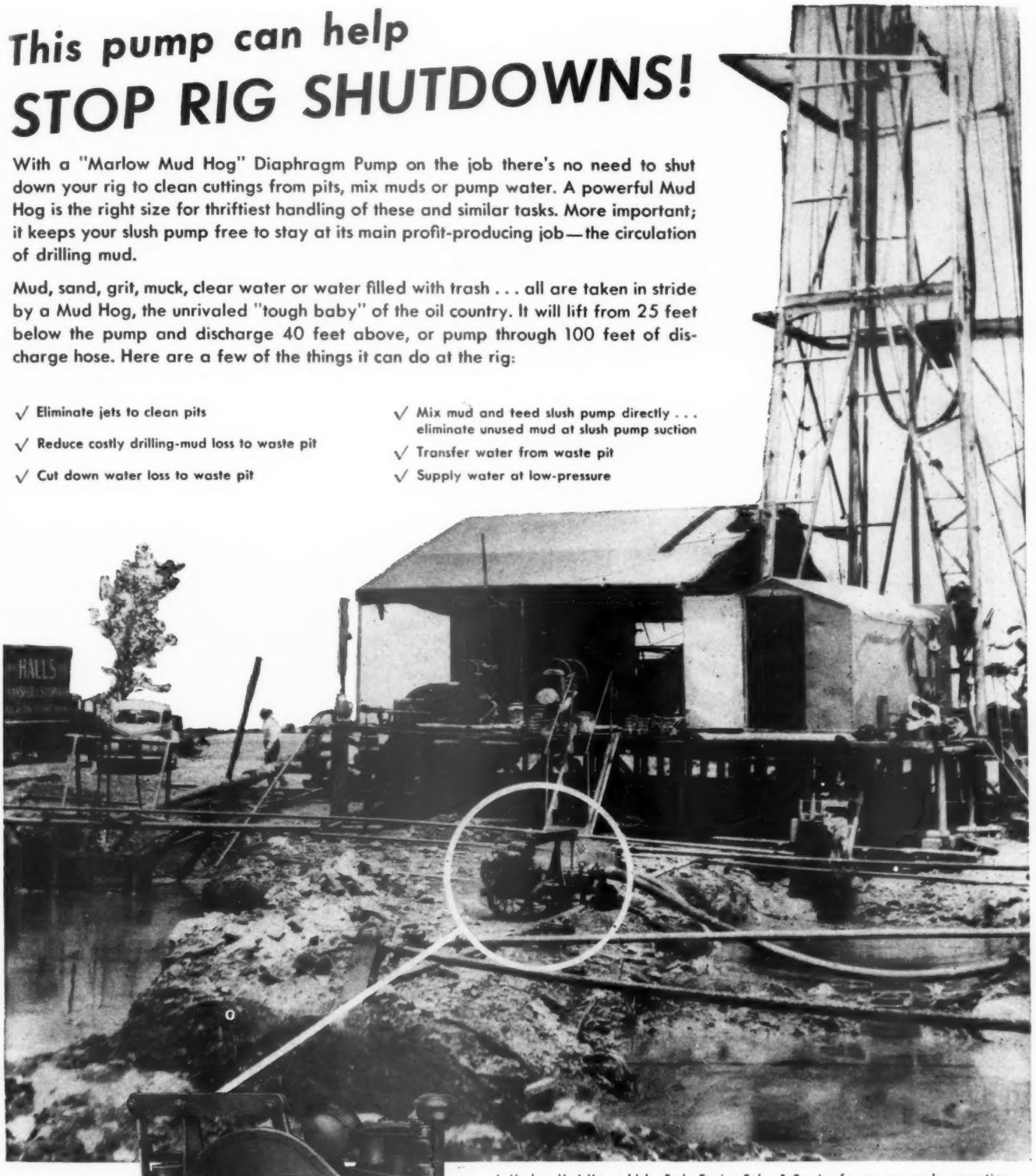

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Houston, Texas. The above shows clearly the spirit in France to make a recovery, at least in the petroleum industry. A lag in other types of industry is due more to lack of certain raw materials, which France needs and is unable to obtain because of the shortage of dollars. The U. S. suppliers cannot accept payment in the devalued French franc.

Touring the oil fields. The writer's first assignment was to acquaint himself with operations in Southern France and Alsace. As automobiles were scarce and gasoline rationed, it was necessary to travel by train most of the time.

The first trip was made by car with Mr. Navarre, director of the Institute. The route was through Lyon and the valley of the Rhone. This was the scene of the great German retreat from Southern France. Along miles and miles of the highway, German trucks, guns, tanks are strewn, put out of action by the U. S. air force. It seemed that here was a large supply of scrap iron, which the French steel mills could use, but after two years it was still lining the highway. The road passes through Nimes, where a fine Roman coliseum still stands in better state of preservation than the one in Rome. The beautiful Roman temple known as the "Maison Carree," still in a fine state of preservation, has its counterpart in Richmond, Virginia, in the form of its capitol. In Montpellier are the headquarters of the Societe des Petroles du Languedoc Mediterraneen (S.N.P.L.M.), which has a 2-million acre concession. Within this concession are about 12 beautiful structures and the first oil field in southern France dating from 1924, producing 160 gal per day from 4 wells from the Keuper (Jurassic) at about 350 ft. The cumulative production of the Gabian field through 1947 is about 188,000 bbl.

As the visit was before the reception of new drilling material from the U. S. A., the rigs and machinery in use were of the oldest type imaginable and made up of German, French, and U. S. manufacture. There were frequent breakdowns and drilling was extremely slow. Moreover, there was a lack of trained personnel in the operating and engineering branches, which is true of all oil companies in France and the colonies. Towards the middle of 1947, new complete rigs and drawworks were received from the U. S. A., resulting in improvement of operations.

The S.N.P.L.M. has some excellent prospects. The Lavaunage structure, south of Nimes, has the indication of a gas field. The No. 1 well found a gas zone at about 8600 ft with a bottom hole pressure of 5000 psi, but unfortunately the well ran into difficulties and the hole was lost. The No. 2, being drilled by a heavy rotary rig, should open this zone. It has been reported recently that one of the company's wildcat wells near Bezieres found oil at about 2400 ft in the Keuper. Altogether the company is operating 5 heavy rotaries and 5 light rigs, mostly for geological prospecting. The future of this company appears good; they have the structures, great thicknesses of sedimentaries, oil seeps, and good equipment. There are also indications that some of the structures along the coast may continue into the Mediterranean, so some time in the future they may have to consider offshore drilling. The company is ably managed by Mr. Dumas, the president, and Mr. Demargne, the managing director at Montpellier.

From the Languedoc region, the party traveled across one of the greatest grape-growing sections in the country to St. Gaudens, which is some 60 miles south of Toulouse, and is the headquarters of the Regie Autonome des Petroles (R.A.P.). Under the experienced management of Mr. J. deVries and Mr. Moch, the president, it is the only company in southern France operating at a profit. Though having the smallest concession, 600,000 acres, it has St. Marcet, the only gas field in France at present. It is a wet gas running 0.8 gal per 1000 cu ft. Production at the end of 1947 was about 19,000,000 cu ft per day from 8 wells produced in rotation. The potential from the wells drilled is several hundred million cubic feet per day, which will be ample for the new absorption plant. The reserves of the field as of mid-1947 were calculated to be 250 billion cu ft, which gives the field a life of about 17 years at the capacity of the new plant.

The field has two producing oil wells that reached the Jurassic, which is faulted upward on the flanks of the St. Marcet structure. St. Marcet No. 1, drilled in 1943, has produced contindays only and was killed due to mechanical difficulties. In late 1947 the well was finally cleaned out and is now flowing about 125 bbl per day. No. 11, drilled in 1943, has produced continually from the same formation about 18 bbl per day. Cumulative production of oil through 1947 is some 25,000 bbl, which has been refined at the Socony-Vacuum's refinery, Cie. Industrielle des Petroles, at Frontignan on the Mediterranean.

The St. Marcet structure is beautifully outlined on the surface with the field in an anticlinal valley. The structure is some 5 miles long and 1½ miles wide. At depth the dips steepen and the structure assumes a mushroom-like shape, strongly faulted on the flanks, the faults having brought up the Jurassic to within reach of the drill. The gas zone is in a Cretaceous breccia at the base of the Flysch, varying in depth from 4800 to 5015 ft with a thickness of 225 ft. To date 19 wells have been drilled, 8 of which are productive. As the present wells have developed sufficient gas production for future needs, exploration on the flanks is being carried on to find the Jurassic oil zone. Due to faulting and the complicated nature of the structure, this may be difficult.

The R.A.P. has some ten well-defined structures on its concession, eight of which have been drilled without results or are in the process of being drilled. In some instances, locations were not too well chosen due to lack of sub-surface information and inadequate seismic work. In 1947, the company drilled more than 45,000 ft of hole and completed as a dry hole Puymaurin No. 1 to a depth of 13,268 ft, which is the deepest well in Europe and probably outside of the U. S. A. Considering the old drilling equipment in use, this was quite an achievement. The Proupiary structure, adjoining the St. Marcet gas field, may be another gas field as the No. 1 well is producing a small flow of gas.

It was around St. Marcet that the oil

THE AUTHOR

Edward (Ted) D. Lynton, born in New York City, was educated in Switzerland, France, England, and the Missouri School of Mines, where he obtained B.S. and E.M. degrees. He has had a long and active career in the oil industry on several continents. After mining in Mexico for six years, he entered the oil business in 1919 at Tampico for the Mexican-Eagle. In 1920 he joined Standard Oil Company of California as a geologist and engineer and later as in the research and development department of Standard of California from 1931 to 1942. Lynton was appointed specialist on oil mining and other industries for French North Africa, and for over a year was chief of the Procurement and Development Division of the North African Joint Economic Mission in Morocco. For this work he received the decoration of "Commander of Ouissam Alouite" from the Moroccan government. In 1946 he was appointed oil consultant to the Institut du Petrole in Paris for two years. He returned to the California Research Corporation and now resides at 1520 Arch Street, Berkeley, California.

4*

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field men started the underground resistance and later came out in the open on D-day. Unfortunately, they were a little premature as the Germans were still in force. The results were that many good men were captured and executed. It is not unusual to see along the roads small monumental shafts erected at the execution spot with the names of the men, followed by their occupation such as driller, derrickman, roustabout, mechanic, etc.

The town of St. Gaudens, headquarters of the R.A.P., is a typical small French town with narrow streets, old buildings and a medieval church. Its location on a high terrace overlooking the Garonne river and facing the high Pyrennees to the south is an oil man's dream. Social life centers around the "Restaurant des Trois Marechaux" and "Les Cominges" whose terraces and tables allow the weary oil man to gaze upon snow-capped mountains while he leisurely sips an "apéritif."

The R.A.P. concession is surrounded on three sides by the largest concession in France granted to the Societe Nationale des Petroles d'Aquitaine (S.N.P.A.). It covers an area of some 7,000,000 acres. The more interesting structures are situated in the southwestern part of the concession along the Pyrennean front for which reason the structures become complicated with depth. Near the town of Ortez is found a large seep in a limestone quarry. On a hot day the seep is quite live. In 1947, the S.N.P.A. drilled some 22,000 ft of hole but so far has no commercial oil or gas production. Their Audignon No. 1, site of the drilling school, in the latter part of 1947 did find a small amount of oil in a 50-ft limestone section 7570 to 7620 ft. By bailing the well can produce 5 bbl of oil. This showing in an entirely new area proved so encouraging that Audignon No. 2 was started in early 1948.

The S.N.P.A.'s main office is in Toulouse and has an executive office in Paris, as have the other companies. Mr. Blanchard is president and Mr. de Panafieu, general manager in Toulouse. The field offices and warehouse are in the charming town of Pau, where Mr. Cauchois, manager of operations, holds sway. Prior to the war, Pau was a mecca for English tourists and many kept homes there until forced out by the Germans. Like St. Gaudens, it is situated on a high terrace facing the Pyrennees, which are easily accessible for winter sports.

In reviewing the French oil operations from the time drilling was seriously resumed after the liberation, it is remarkable that they were able to drill as much as they did with the old equipment on hand and considering the inadequate trained personnel. Most of the equipment is pre-war machinery or material of German manufacture left behind by the Germans, who did a certain amount of exploratory work during the occupation. In 1947 new U. S. A. equipment began to arrive for the S.N.P.A. and S.N.P.L.M., while the R.A.P. ordered spare parts and one 5000-ft portable rig. Some improvement in drilling speed was attained but far below that reached in the U.S.A. The French driller, unaccustomed to high speed rigs could not obtain the maximum efficiency from them, the greatest percentage of lost time being going in and out of the hole. The organization around the drilling wells is not conducive to the highest efficiency. Neither a driller nor tool pusher has enough authority over a drilling well, being subject to the orders of a young petroleum engineer on the well with inadequate experience to conduct the operations.

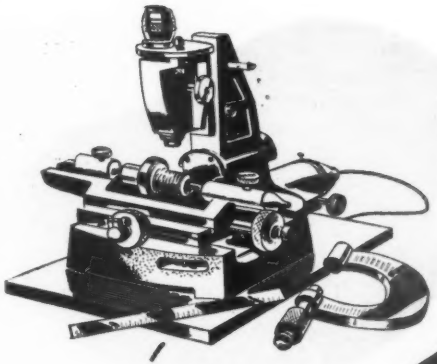
Up to the middle of 1947, safety regulations and practice were disregarded in the oil fields. In fact the drilling crew would "kid" a derrickman about being without courage if he used a safety belt. A sobering effect was the death of a young derrickman who fell to the derrick floor. The French companies are now realizing that safety is important and one now has a safety engineer. There is little doubt others will follow suit in time. A good start has been made by all the companies issuing safety instructions.

To carry on good oil field practice in France, it was realized that trained personnel would prove the most effective. During 1946 to 1948, the oil companies at different times sent their key men to the U. S. to tour the fields and study the methods. These trips lasted 3 to 4 months but on the whole were unsatisfactory as the Frenchmen, unable to participate in the work itself, could do little but observe. In some cases, drillers and engineers were able to work within an American organization for a brief period as guests. Frenchmen worked on fishing and gun-perforating jobs, and on cementing operations with service companies. Some of the petroleum engineers worked in the laboratories and fields of major oil companies for several months. Some tool-pushers worked in the plants of equipment manufacturers to learn the handling of equipment to be sent to France. The number of Frenchmen sent to the U.S.A. was a small percentage. The required number of drillers could not engage in drilling operations in the U.S.A., and there were unsurmountable difficulties to sending men there to learn drilling within an American oil company. Therefore, besides the time element, only a small minority could journey to this country to study American methods. This "bottleneck" gave birth to the idea of a drilling school run by American driller - instructors and French personnel.

When the idea was proposed to the French oil companies, only the S.N.P.A. was willing to turn over a wildcat well for a drilling school. Much credit is due this company and its officers for putting into operation a new venture. The S.N.P.L.M. accepted a number of engineering students in a school at Caveirac. The school consisted of class room courses in drilling operations with some practical work as roustabouts around a rig. These men were extras on the drilling crew and had little chance to do any actual drilling. The routine was not very satisfactory, but, later the more adept ones were sent to the drilling school where they had a chance to put their hands on the brake. The R.A.P. had a school of higher instruction at St. Gaudens. Their practice was to take a few members from their drilling crews, older men with little or no engineering education and give them class room instruction. In one year only ten men were advanced to driller or assistant driller. This method proved slow and did not bring in new blood or train younger men for drillers 'posts.

The idea of the drilling school is to train the largest number of younger men possible in two or more years and to have them actually perform all the duties around the rig by rotation. The first step was for the writer to fly to Texas in 1946 with Mr. Nougaro and recruit six drillers, two derrickmen, and a tool-pusher. Mr. Fred Dallas of Houston was found to be an ideal instructor, one who had some 35 years' experience and the personality to head the drilling school in the field. After two years, Mr. Dallas is still running the drilling school which is now in Morocco. While the American drillers were being recruited, the derrick was erected at Audignon No. 1 about six miles from St. Sever (Landes). Mr. Garand in Paris, head of the Institute's training program was screening several hundred aspirants to be sent both to Caveirac and St. Sever. The young men selected were graduate petroleum engineer, geologists, air force men, mechanics from the French navy, etc., all of them anxious to have the opportunity of learning the oil business, a comparatively new industry in France and the colonies with the possibility of working not only in France but abroad.

At Audignon No. 1 four American drillers, two derrickmen and Mr. Dal-



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las with 35 students formed the drilling school. Each driller kept his own crew and drilled seven days with two days off and then rotated tours. The fourth crew acted as surface gang for part of the day, the afternoon being spent in class room work. For the first few months there were considerable difficulties. The equipment at Audignon was about the poorest and oldest in France and for many months only one mud pump operated. Breakdowns were frequent, electric power was shut-off without warning and replacement parts were lacking. There was the language difficulty and hesitation on the part of French company officials to follow Mr. Dallas' recommendations. This may be summed up by a remark made by one of the drillers wondering whether he came over to show American methods to the French or to learn their methods. Though repair work and fishing jobs slowed down drilling, this may be considered fortunate in a way because it gave the students a wide variety of experience. Regardless of all these difficulties, the students carried the well to more than 7630 ft in about 15 months, 65 days of which were spent on one fishing job. Their drilling rate, except in one or two instances was equal or better than that of most wells in southern France. These students even had the experience of placing this well on production, the well producing 5 bbl per day from a tight zone at 7570 ft.

There was no doubt the drilling school proved an unqualified success. During the period of 15 months some 40 young men received a thorough training and are now better qualified to work on a rig than any floormen or derrickmen of the oil companies in France. Not one student was killed or seriously injured because they were taught "safety first." Due to this success, the drilling school and American personnel were transferred to Morocco where they were assigned to operating new equipment. If the Audignon drilling school had been assigned to the new rig, the American drillers and their French crews would have turned out a drilling rate beyond any achieved in France, but the S.N.P.A. were unwilling to do this for reasons not difficult to guess. A French crew averaged about a 1000 feet per month with the new rig.

French geologists working for the different oil companies are very proficient and show excellent training. The French universities specializing in geology give splendid courses in all phases and the summer field work in Switzerland, the Pyrennees and the Juras afford them experience in some of the most complicated regions in the world. Due to scarcity of cars, the chief geologist of each company is the only one fortunate enough to have one. The field geologists are quartered in some small French village near their work and mainly use bicycles for transportation. In hilly country, the bicycles are abandoned and field work is done on foot. This results in careful and detailed mapping. The finished maps are beautifully prepared and presented in the best possible manner. Geologists such as Oregval and Mainguy of S.N.P.L.M., Bonnard of S.N.P.A., Michel of R.A.P., Bruderer and Levy of S.C.P. in Morocco, Schneegans of the Institute rank with the best in Europe and the U.S.A.

All companies and the Institute have existensive micropalaeontological laboratories where foraminifera from surface formations, well cores and cuttings are studied for correlation purposes. Moreover, the micropalaeontological staffs are making a valuable contribution to research work in France under the guidance of Ostrovsky of S.N.P.L.M., Perebaskine of R.A.P., Milekoff of S.N.P.A. and Madame Gubler of the Institute in Paris.

▸ **Geophysical prospecting.** In France, geophysical prospecting, especially seismic, lags far behind the U.S. Due to this, many wells are poorly located with respect to deep zones. Only one company contracts for this type of work, concentrating on gravimetric and "tellurique" surveys. The latter method is used extensively and except for mapping shallow structures does not successfully outline the deeper sub-surface. The gravimeter has been a successful reconnaissance instrument and checks the "tellurique" wherever the two have been used in the same area. Due to its great cost, seismic work should be in the fore but lags behind the others. Seismic is essential in France, if the geologists are to know the attitude of the beds in the underlying Jurassic, unconformable with the overlying sediments. Too few seismic sections have been made, generally one or two sections to a structure, resulting in insufficient information. The steeper dips could not be determined. In some areas reflections could not be obtained, which later were proved to exist.

The difficulties of seismic work were not due to the French geophysicists, who are well trained theoretically in this science, but to out-dated equipment, and lack of practical field methods in the production of shot holes. The high cost of surveys are due to the few number of shot holes drilled per day. To ameliorate these conditions and to make oil companies more seismic-minded, the French geophysical company purchased a new recording truck, water and shooting trucks for delivery in November 1946. The Institute on its part arranged with the Seismograph Service Company of Tulsa to send Mr. E. B. Lindsey, party chief and Mr. Noel Frost, observer to France for six months to instruct the seismic party. Unfortunately, it was May 1947 before the two new shot-hole drills arrived on the job. Consequently, Mr. Lindsey had to work with two old drills, which broke down repeatedly. Regardless of this he was able to increase the number of holes attained prior to his arrival.

The French crews running the shot hole drills are responsible mainly for the poor production. The importance of this department is considerable in seismic work. French crews shut down for meals and slow down, if they are liable to surpass the previous day's work. If a breakdown occurs, the whole crew takes the drill to a machine shop in town for repairs. Drillers are very important individuals on a seismic crew. In the U.S.A. they are considered more as members of the party than as drillers, while in France they are just workmen. Drills used in France are too big, too heavy, too cumbersome, and therefore too slow. Much time is wasted in maintaining unnecessary elements and carrying out preliminary operations. Until speedier shot hole drilling is achieved, French seismic costs will remain high and progress of the survey slow. In view of the attitude of the French drilling crews who are adverse to adopting newer and more rapid methods, a solution would be to replace them with younger drillers, recently trained in the drilling school and instilling in them a competitive spirit. Only with a thorough reorganization of drilling practice can this geophysical company keep the recording truck and technicians busy. However, in spite of all the difficulties experienced in the field by Mr. Lindsey and Mr. Frost, their six month stay proved very beneficial to the French geophysicists and oil companies by bringing them up to date with developments in seismic technique perfected during and after the war.

▸ **Pechelbronn.** During the writer's sojourn in France, several visits were made to the oil fields of Pechelbronn, 19 miles north of Strasbourg. It is about the only place in the world where one can see a well pumping at the surface, then descend a mine shaft, walk to the general locality of the well and actually see the oil sand from which the production is obtained. Such conditions make Pechelbronn unique, for it could be used as a large

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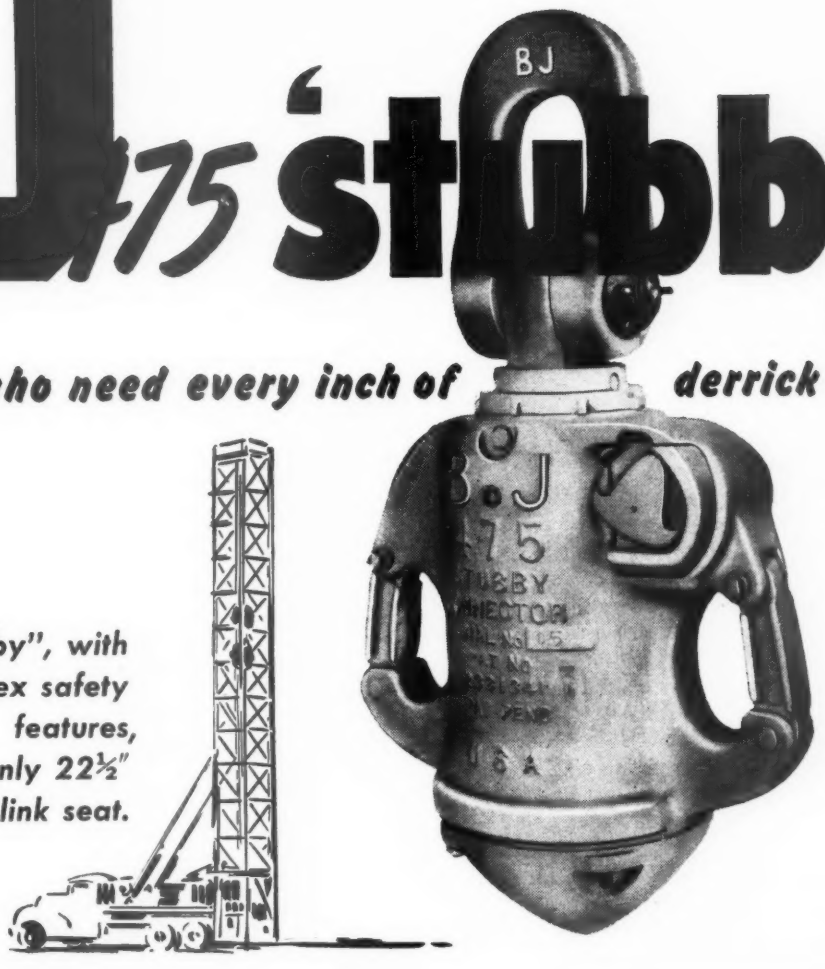

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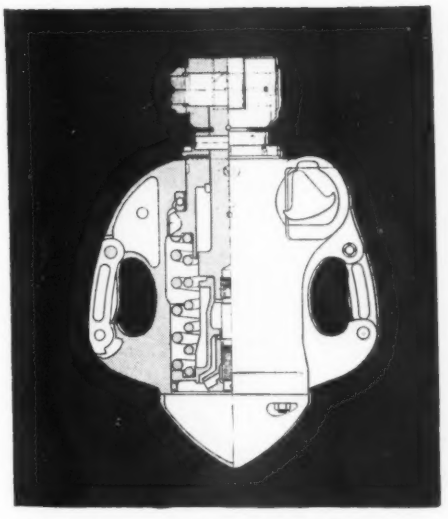

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scale laboratory in production and secondary recovery methods. Unfortunately, Pechelbronn is not taking advantage of this. Here is the ideal place to experiment with gas injection or water flooding at the surface and then study the effects and results underground on certain areas, blocked off for this purpose.

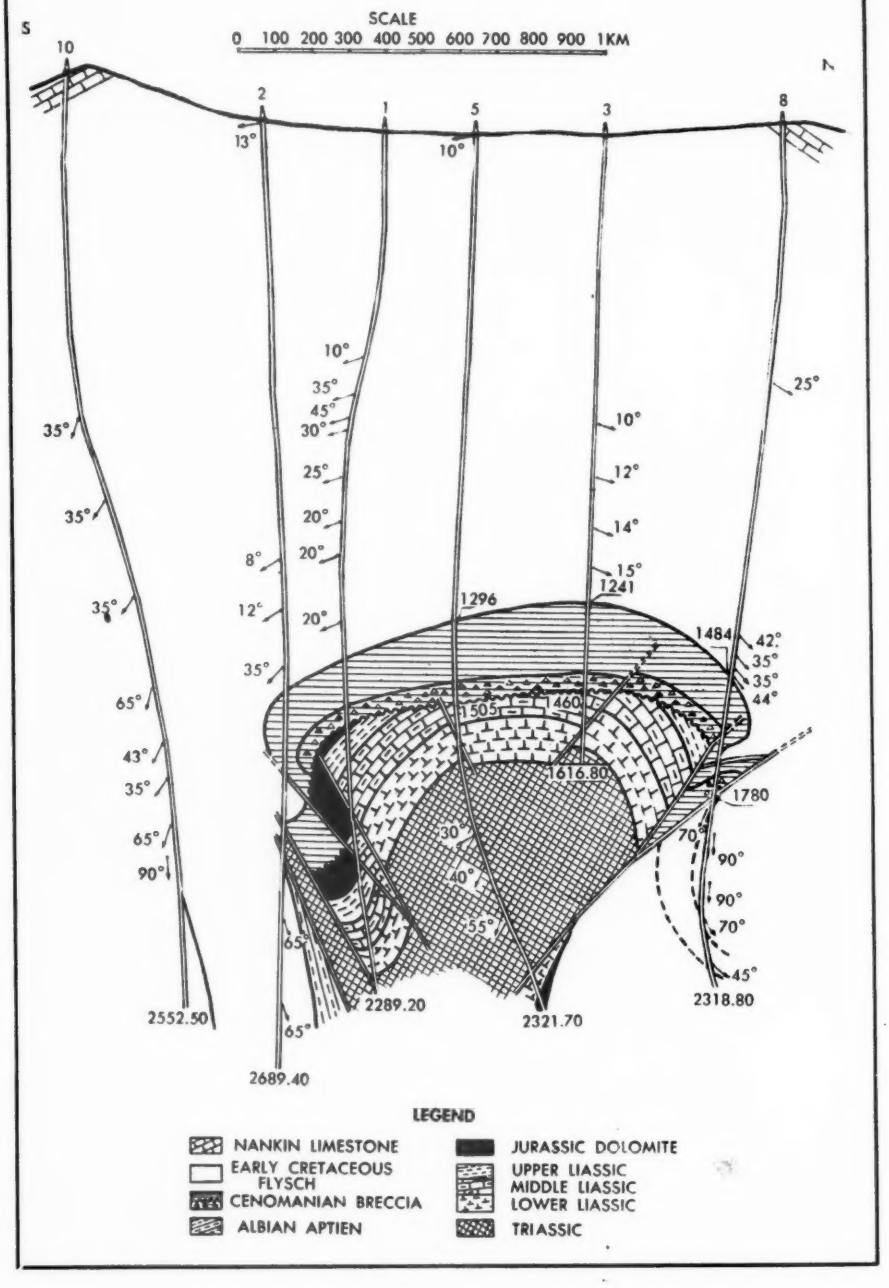
The Pechelbronn concession covers 109,176 acres. To date 47,196 acres have been explored of which 7660 is the known productive area. The field has been producing continually since 1735 except for a slow-down during the last war when the Germans took over the properties with little success in keeping them operating. From inception through 1947, 6,250,000 ft of hole has been drilled and 1,750,000 ft of underground galleries. From this total footage, the wells have a cumulative production of 13,500,000 bbl and the underground workings have seeped oil into the small sumps for pumping to the surface about 5,750,000 bbl. At present there are more than 700 wells pumping 560 bbl per day and four mine shafts, covering an area of 2760 acres from which 400 bbl per day is pumped by an air-lift system to the surface. The productive zones, the upper and lower Pechelbronn (Oligocene) vary from 495 to 1320 ft. Some 700 men are employed on the concession of which over 500 work in the mines.

French North Africa. Among the most interesting experiences were three trips to Morocco and one to Algeria. After spending 1943 and 1944 in both those countries, it was almost like going home. Morocco especially has made great strides towards recovery. Plants and mines, which were barely holding their own in 1944, are producing and prospering.

The most active developments in French North Africa are in Morocco. The Societe Cherifienne des Petroles (S.C.P.) is the only organization with important concessions covering 3,700,000 acres. The company is owned by the French and Moroccan govern- Mr. E. F. Lassauze is managing director; Mr. P. Taranger, general manager.

The S.C.P. has been producing oil in small quantities since 1918. The three oil fields of Ain Hamra, Bou Draa and Tselfat produce less than 100 bbl per day. However in 1934, No. 26 well in Tselfat caused more excitement by coming in for 13,000 bbl per day, catching on fire and completely burning itself out. From that time until 1936, exploration and drilling were confined to localities in which oil seeps occurred. As most of these seeps appear in areas of highly tilted and fractured strata, the structural conditions were not favorable for important production. In 1936 the S.C.P. realized that better prospects for larger production were available in the Miocene foreland and in the coastal plain. This new research paid off last October when Oued Beth No. 7 came in for 1250 bbl per day of 34.5° A.P.I. at 3290 ft from a 140 ft zone in the fractured schist. By May 1948, four additional producers had been drilled, each capable of producing 600-1000 bbl per day. Nothing approaching this production has been found in North Africa. The structure is apparently a buried hill with the Miocene overlying the Palaeozoic. The formations from which the large production is coming are similar to the fractured and weathered schist of the Edison field. For this reason, this field was especially studied by Mr. Taranger last May. The field lies on the west side of the river, Oued Beth. On the east side a range of mountains has been uplifted by a fault, the Burdigalien capping the Jurassic in the vicinity of the EL Kansara dam. The discovery of the field was due to a combination of good geological mapping and geophysics by the "telluriique" method to which is credited a share of the discovery.

Cross-section of the St. Marcet Anticline, gas field at St. Gaudens, (Haute Garonne) France.



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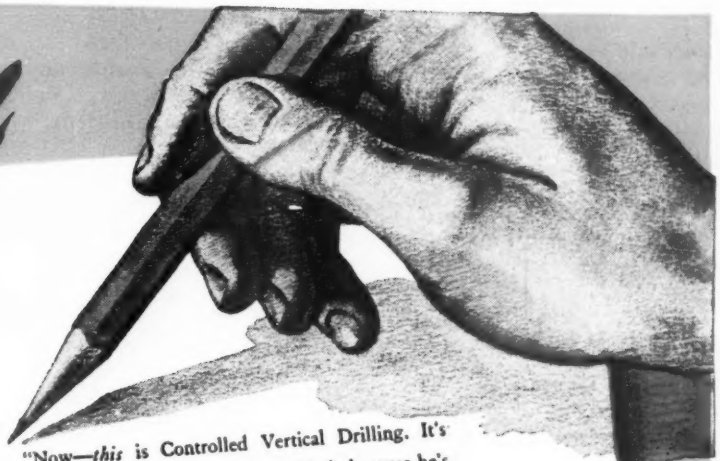

"So they said down at the office that I know something about drilling vertical wells, eh? Well, I ought to . . . I've drilled a lot of 'em.

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"Then there's this — Controlled Directional Drilling, where you're trying to hit a spot some distance from the derrick . . . out under water, say. Reason I mention it is, a lot of men get confused. They think Controlled Directional Drilling and Controlled Vertical Drilling are the same thing used two different ways. That's wrong. They're two entirely different methods. And the methods and equipment used in one won't work in the other—just remember that!

"Now—*this* is Controlled Vertical Drilling. It's where the driller makes plenty of hole because he's always using the correct weight and speed—*straight* hole because he never lets it get beyond the critical angle. Critical angle? That's the angle at which the forces which cause hole deflection really become established. It varies with the size of the hole, drill collar, and so on, but it's always small. Some men figure it something less than 2 degrees: me, I'd like to keep the angle of the hole less than 1 degree. Any deviation less than that is easy to correct, but you can buy yourself a lot of grief if hole deflection gets beyond that angle.

"How do you know what the hole's doing? A smart question, because that's the heart of Controlled Vertical Drilling. The driller's *got* to know what's happening every foot of the way. And the only way to know is to take frequent readings with an inclination recorder that's accurate down to small fractions of one degree. I use a Totco Recorder myself—been using it for years—because it *is* accurate to less than an eighth of a degree, because I can *always* depend on its readings, because it's simple to use, and can be dropped down the drill pipe, run on measuring or sand line, or with retractable coring equipment.

"That's the whole basis of Controlled Vertical Drilling . . . take frequent readings with a reliable recorder; never let hole deflections get beyond the critical angle; use the information the recorder supplies as a guide for correct weight and speed to cut each formation efficiently. That's the way to drill *better* wells, drill 'em faster, drill 'em cheaper."

*Based upon the actual statements of hundreds of drillers and drilling superintendents in all parts of the country, and in many foreign fields.

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In December 1947, Fred Dallas was sent to Morocco to superintend the drilling school under the sponsorship of the Institut du Petrole. Three American drillers had preceded him in mid-1947. After terminating their contract, they were recently replaced by J. R. Hughes of Bakersfield, T. R. Wilburn of Houston, and D. C. Hamill of Burbank, Calif. The school first operated with one of the two new 9500 ft outfits that had just reached Morocco. It was a treat to see how the Americans and French students, accustomed to worn-out French equipment, speeded up the drilling operations and displayed more interest with the new equipment. Very soon drilling records were broken, such as in one instance. drilling and setting pipe at approximately 270 ft within 24 hours. Latest reports indicate that the drilling school will be installed on a heavy duty rig to drill a deep test on a geophysical structure near Port Lyautey.

▸ **American visitors.** During the two years in France, it was remarkable the number of American and British oil men who visited the Institute and the oil operations. Some came at the invitation of the Institute on special assignments and others in the course of business for their companies. The efforts put out by the French in their oil ventures made a good impression on all. It was the writer's privilege and pleasure to accompany these engineers through all the concessions and assist them in explaining their various equipment.

The Institute invited for a brief stay in France several well known oil men for instruction purposes. In July and August 1947, Prof. and Mrs. L. C. Uren of the University of California were guests of the Institute. Prof. Uren for one month delivered a series of lectures at the University of Toulouse to some 80 French engineers and post-graduate students. Prof. Uren spoke in English very slowly and it was remarkable how well the French understood his lectures. The month of August was spent visiting all the oil operations in France, which included a wonderful trip by car along the crest of the Pyrennees from Luchon to Bayonne and across the Spanish border to Irun. Prof. Uren was also flown to Casablanca for a tour of the activities in Morocco, during which time consultations were carried on with the officers and departmental managers of the S.C.P.

Mr. N. A. (Nick) Kendall came on leave of absence from the Standard Oil Company of Texas, primarily to aid the French mud engineers in the latest methods of mud conditioning and petroleum engineering field technique. During Mr. Kendall's three months' stay, he divided his time between the three oil companies in southern France and also spent 10 days in Morocco collaborating with Mr. Emile Dutrieux, who had recently returned from California, where he had spent three months as a mud man at the invitation of the Standard Oil Company of California.

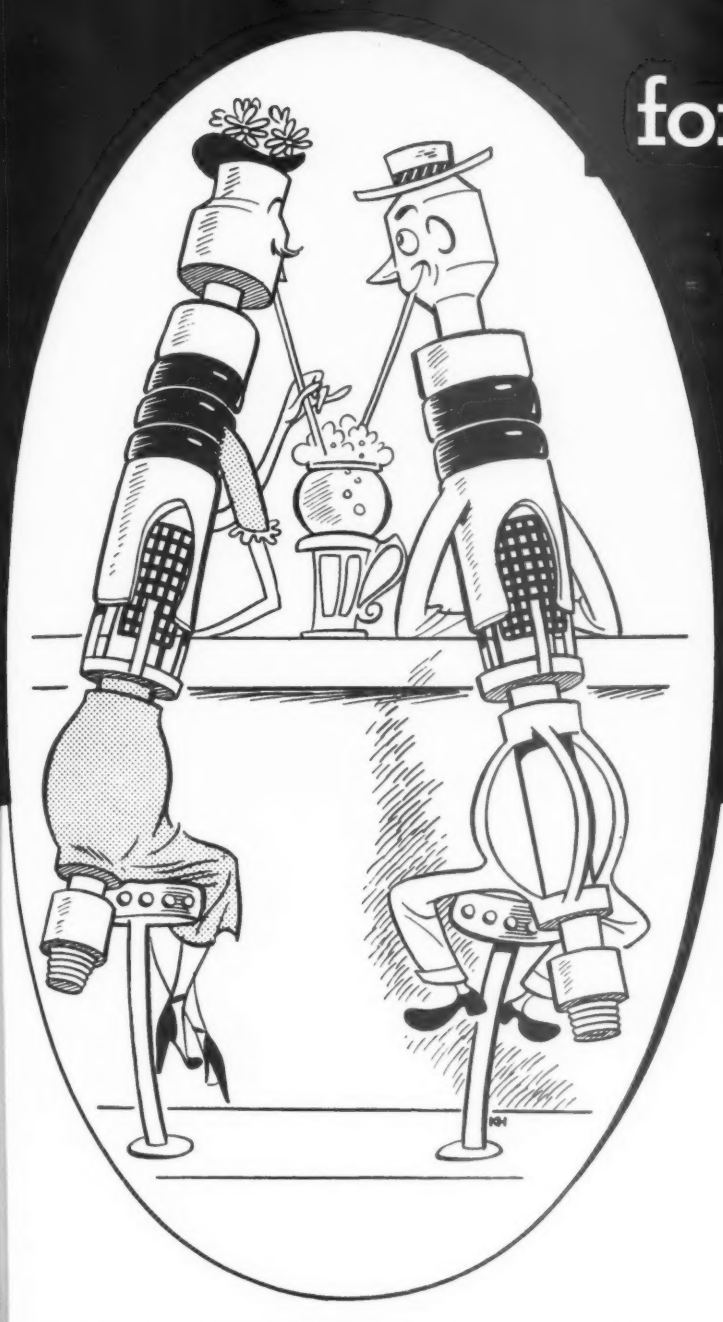
It has been the practice in France not to make formation tests even though formation tester was available. The reason is that the personnel was not familiar with the tool and feared sticking it in the hole. Testing was done by cementing pipe and gun-perforating. It is believed some promising zones, giving inadequate results, were abandoned as non-productive.

▸ **Conservation.** France has no oil and gas conservation program such as is prevalent in the oil states of the U.S.A. The French mining industry has a government agency controlling the mines. This same agency investigated the possibility of controlling oil operations, but as these engineers were mining men with no oil experience, it seemed doubtful whether they were capable of supervising drilling and production such as is done in California by the Oil and Gas Conservation Committee of the State Mining Bureau. To assist the French in setting up a similar committee in France, the regulations of the California Oil and Gas Conservation Committee were translated into French as a guide towards instituting similar laws in France. There is need for such supervision, as the companies are not subject to inspection and are responsible to their own managements only. Water shut offs or production tests are not witnessed by any outside agency. The first tentative regulations set up by the mining men were too wide and stringent, covering operations with which they should not concern themselves. The California oil and gas regulations of the State Mining Bureau seemed to be as fair as any and were therefore presented to the French government as a basis on which to set up laws suitable to their temperament.

▸ **Purchasing agency.** After the liberation, the procurement of several million dollars of oil equipment for France presented quite a problem. It must be realized that during six years' of war, new tools and equipment were produced in the U.S.A. that were practically unknown to the French because of their lack of contact and the complete absence of trade publications. A government agency, "Societe Nationale de Materiel pour la Recherche et l'Exploitation du Petrole" (S.N.M.A.R.E.P.) was set up in Paris under the directorship of Mr. Emmanuelli. To this agency was apportioned the dollars and other currencies necessary to purchase supplies for the oil companies, not only in the U.S.A. but in other European countries. The oil companies could not purchase directly from abroad because they do not have the foreign currency, so they place their orders with S.N.M.A.R.E.P. and pay them in francs. Soon after the liberation, Emmannuelli and Lassauze with several engineers visited oil equipment companies in the U.S.A. to select the best and most recent material for France. A staff was installed in New York to inspect and purchase material. During the last year, purchases have fallen off considerably due to the dollar shortage but sufficient equipment is now in operation to insure considerable improvement in drilling technique over the pre-war years.

▸ **Drilling contractor.** There is only one drilling contracting company in France, known as "Forex." The head is Mr. Godet. Mr. Maratier in Paris and Mr. Barth in St. Gaudens are experienced operators and assist Mr. Godet. "Forex" has three strings of tools operating and though they have only old material with which to work, their drilling rate in many instances surpass that of the companies operating their own rigs. "Forex" has the only steam rig in France; the set of five boilers being re-vamped are old locomotive boilers. They use five men crews, some of the drillers being Dutch personnel with experience in the East Indies.

▸ **Foreign concessions.** France has sufficient structures mapped both at home and the Colonies to keep them busy drilling for many years at their present rate of operations. Many interesting areas such as the Paris and Juras basins have not been mapped by geophysics for possible structures. To hasten recovery, reduce purchases of crude abroad, and conserve foreign exchange, the country needs the oil now. Operations as carried on at present are very expensive and a drain on government finances. Until recently, France has been jealous of her mineral wealth and has not been inclined to grant concessions to foreign companies to develop her oil resources. The government has been unable to realize that oil exploration and development is an expensive and risky business. Granting of concessions for the development of oil would be a boon to France. Upon discovery, the government would receive at least a 10 per cent royalty and could have the option of purchasing at least 60 per cent more of the crude. There is no doubt all the production would be refined in France, as refinery capacity



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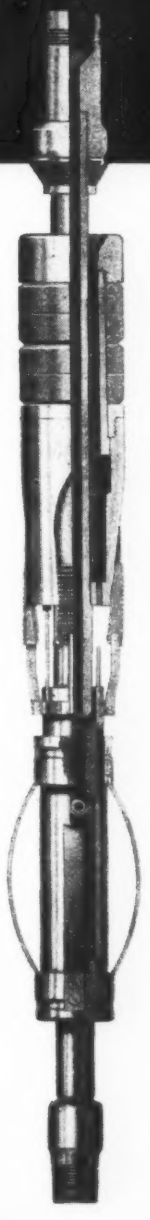

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is large, and no crude need be exported. Moreover, American geophysical and oil companies operating in France would employ at least 80 per cent French personnel. This would train more men, more rapidly than any present system.

The first company to obtain an important concession in 1947 in metropolitan France is the Standard Francaise des Petroles, the French subsidiary of the Standard Oil of New Jersey. This concession, consisting of 4,200,000 acres, lies in southwestern France centering around Bordeaux, with its southern boundary almost adjoining the northwestern limits of the S.N.P.A. concession. This is an interesting area lying westerly of the central massive uplift. As a consequence other companies such as the Gulf and Jupiter (Shell) have applied for concessions in Tunisia and Algeria, in areas of excellent possibilities. As far as the writer knows, no application has been made to date for concessions in Morocco or other areas such as the Gabon in French Equatorial Africa, French West Africa, Madagascar, etc.

The two years in France left the impression that the oil men there are working hard and seriously to place the industry on a firm footing. It will take some years to organize and approach the methods used in the U.S.A. but if effort will do it, their goal will be achieved. The most serious problem is lack of trained personnel. To improve this condition the Institute of Petroleum in Paris is anxious to place their best students as trainees with American oil companies, equipment and geophysical companies for a period of one to two years. These engineers and geologists have been trained in the best French technical universities and have then taken post graduate work at the Ecole Superieure Nationale de Petrole. Their scholastic training makes them available to work as geologists, petroleum engineers, chemical research and refinery workers. They are fitted to enter an oil company and work side by side with Americans. The Institute supplies their travel expenses from France and return but they must be self supporting during their stay.

The Institute invites American companies to take one or two of their graduates on a two-year training program. These men will give their best efforts to the job and fill in temporary positions open on account of lack of personnel in certain departments. Oil companies mainly object to this idea because they hesitate to hire a man on a temporary basis. On the other hand there is an advantage in knowing that since this employee is not necessarily permanent he can be returned to France when work slacks off. Arrangements can be made to employ trainees in American foreign operations.

The Institute and the French oil companies also offer an exchange of personnel. The companies in southern France will accept the son of an oil executive who is in a position to give a French engineer or geologist employment with his company. The French oil company will give the American boy a job in their organization, which will give him the opportunity to earn his living, learn the language and see the country on his time off. This exchange should last at least a year. To date about six excellent engineers and geologists have been placed as trainees among several organizations in the U.S.A., but the Institute in Paris would like to place more.

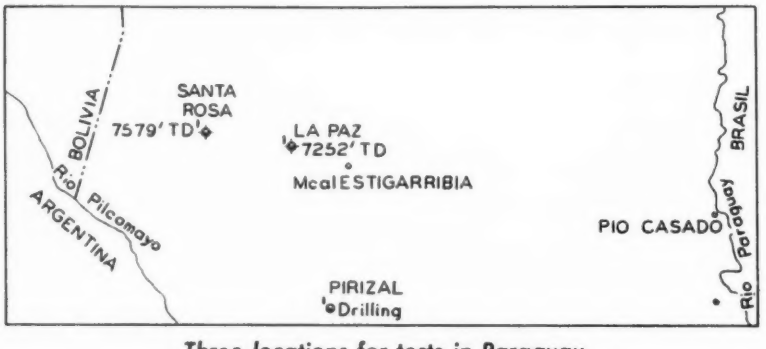
* * *

THIRD WELL DRILLING IN THE PARAGUAYAN CHACO

By RICHARD SNEDDON

UNION OIL COMPANY OF CALIFORNIA under contract with the Paraguayan Government to explore and exploit some 55,000,000 acres in the Gran Chaco region, has had little luck so far, but has not by any means given up hope. The huge area covered by the agreement is virtually undeveloped and a major part of the exploration problem has been to clear off working areas, establish a satisfactory transportation system, and provide adequate facilities for the housing and feeding of both American and Paraguayan workmen. Of necessity, the preliminary work has been slow, but it is to be expected that the pace will be accelerated as progress continues.

Up to the moment two wells have been completed and abandoned, and a third one, Pirizal No. 1, as of August 23, 1948, was drilling at 7565 ft in a red bed series of Continental origin, with no showings of oil or gas. Under the terms of the agreement, Union is permitted to select exploratory blocks of approximately 24,700 acres, on which drilling operations are to be begun within 18 months of the selection. Thereafter, drilling must continue until oil is discovered or the block is released. Immediately after the agreement had been signed, Union sent geophysical parties into the field, and despite great handicaps, three crews have since been operating almost continuously. This exploratory work, incidentally, is being done by Western Geophysical Company, under the direction of E. B. Noble, Union's manager of exploration, and the drilling is being handled by Drilling and Exploration Company.



Three locations for tests in Paraguay

A first well, Santa Rosa No. 1, was spudded about July 1, 1946, and was abandoned after going down to 7579 ft. A second well, La Paz No. 1, located some 40 miles east of the Santa Rosa project and about 225 miles from the Rio Paraguay was also abandoned after being carried to 7252 ft. The third well, as already stated, was drilling ahead toward the end of August with no showings of oil or gas up to that time.

Transportation difficulties in the Chaco have been greatly alleviated by the acquisition of a C-47 plane and the establishment of several landing fields close to the areas of geophysical operations and the active drilling site. Union's central field camp is located at Mariscal Estigarribia, where there is maintained a supply warehouse, and adequate housing has been erected for both American and Paraguayan personnel. The entire Paraguayan operations are under the immediate supervision of Chester Cassel, resident manager.

* * *

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EXCLUSIVE

Dry Hole Survey Lessens Water Flooding Hazards

By F. R. COZZENS

IN re-drilling unfamiliar territory, few incidents put a deeper dent in an oil man's enthusiasm than to discover that his nearly-completed well is just off the site of an unsuspected dry-hole. Such incidents, with slight variations, occur so often in stripper fields, however, that they fail to incite more than local interest, except to recall the fact that inadequate dry-hole knowledge is a major cause of exploratory failures. Undetected or forgotten dry-holes and abandonments have already cost stripper operators thousands of dollars in materials and wasted effort. Such losses are often greater when secondary oil recovery measures are applied, because the inclusion of one or more such holes may influence the production of a pattern, and the failure of one pattern has often been sufficient to ruin an entire secondary recovery project.

Due to the rigidity of present state mining laws, relative to the recording and plugging of abandoned wells, it would appear that the problem, from a practical standpoint, was solved. The menace that now confronts operators, however, is not of the present but of the past, dating back to that period between 1860-1930, when, in the rush to drill new wells, it was the custom to dispose of non-producers as expeditiously as possible. Few were plugged. Property owners and farmers sawed off the drive-pipe below plow depth, bridged the openings, and the surface was tilled and grazed over until many of the sites became an indistinguishable part of the landscape. As pioneer operators, field crews, and landowners passed on, the history of the old wells became vague, and in many cases was forgotten entirely. Present day operators who are re-drilling old fields preparatory to beginning secondary oil recovery measures, must either gamble with these "ghost-holes" of the past, and proceed on a trial and error basis, or else recognize the hazards involved and proceed accordingly to make a survey. Operators who have sampled the trial and error method are choosing the latter course. An authentic dry-hole record is now deemed fully as important as the performance records of producing wells.

The initial requirement for a workable dry-hole survey is a map of the entire project, made large enough so that each abandonment, as discovered, can be recorded accurately along with producing wells. Actual 'dusters' should be distinguished from abandoned producers, and each site should include a number referring to its history, which can be catalogued in a record book. It is generally advisable to have such maps outlined and scaled by a competent engineer. The lease owner or operator, however, can make the recordings from time to time by using the measuring scale upon which the map is drawn. A necessary supplement for each map is a record book for the recording of well-history, relative to date of drilling, amount of sand, manner of plugging, names of operator or drilling crew, and divers other items which usually prove useful in re-drilling a project. Data are gleaned, generally, a little at a time from various sources and considerable sifting is necessary in order to obtain useful information.

Map recordings are begun by personally checking the project for the sites of old locations. Surface depressions, oil-stains, and cinders (pioneer rigs were steam-powered), are reliable indicators. Sometimes there are remnants of casing, leadlines, and other operating equipment that directs attention to a forgotten site. Personal observations, however, can seldom be relied upon for a complete survey, and much of the necessary information must come from outside sources. The most authentic information may be obtained from former owners and operators who often possess old well-logs and records that can be copied. Sometimes, this data can be supplied from memory. Many of the early operators have passed on, but some may be available for personal interviews, or can be contacted by mail or telephone. Other leads for working data are drilling contractors and lease-crews who were active in the field when the operating was done. These men can generally recall from memory or old labor records, the type and approximate depth of pay formations encountered, shooting practices, casing positions, and whether or not any pipe remains in the hole. This latter detail is especially important if the project is to be flooded. It is also important to inquire in every case about thief formations in unplugged holes that may become persistent robbers of pressure-energy.

By far the most prolific sources of information are farmers and property owners. Many operators are reluctant to interview these sources because of the maze of conflicting accounts. Dry holes were never drilled deep enough, certain producers were plugged for divers reasons, and many promising wells ruined by faulty equipment and careless production methods. In certain cases, this is true. Generally, however, the inquirer can sift from the narratives, sufficient authentic data so as to ascertain the position of questionable drillings on the property, and whether or not they actually produced oil. This, at least, is sufficient to justify a recording on the map. As many map recordings as possible should be made before any exploratory drilling is done. Minor details can be collected, checked over, and recorded under the reference numbers in the record book as explanatory work progresses. As the map relative to the dryhole survey on certain leases becomes complete, operations in those areas can be arranged with comparative safety, and the quest for information can be continued as unfamiliar areas are brought under development.

From history compiled with the dry hole survey, it is usually discovered that certain abandonments must be re-opened and plugged. The necessary equipment for this job is a string of light clean-out tools (drill-stem, jars, bit, and bailer) in diameters to accommodate the holebore. Generally, the re-opening can be accomplished within three to ten days. Hole penetration, however, must proceed with caution because the walls of abandoned wells may not be firm. Drilling mud or brine should always be used to aid in stiffening the walls in long stretches of open hole. If difficulties make it impossible to uncover the pay formation, that area may be sealed off by pouring down the well 300 to 500 lb of cement or clay slurry. The well bore is then filled to the surface with clay, finely pulverized to prevent briding. Some of these old wells have been receptacles for surface drainage over a period of years, and the shot-holes are water-coned, so that a water bank around them extends for some distance into the sand. Water banks, either from surface or

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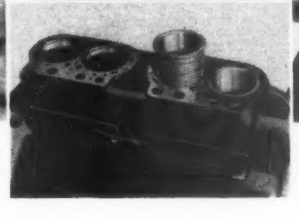

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upper hole drainage are hazards, and unless corrective measures are applied, the condition is likely to result in considerable trapped oil. As oil, from a practical standpoint cannot be forced through a waterbank, an operator usually makes every effort to isolate such areas and to confine them to the smallest possible space. Old wells containing stretches of unsalvaged casing or tubing are most likely to flood, since the pipe prevents natural caving and provides an open avenue for surface drainage. The treatment in all such cases is to reopen the well, plug or seal-off the pay-sand, and induce caving so as to completely close the bore. If the well is known to contain casing or pipe, bore-closings should be made, if possible, immediately below and above the obstructions. Operators usually induce caving by 'squibbing' the wellbore in a desired area with light charges of gelatin or gelamite (15 to 25 lb.), loaded in a 4-in. diam nitroglycerine shell, and detonated by a common 'hot-shot' battery. The remainder of the well bore is then filled in to the surface with clay. Water zones must be reckoned with, however, when recovery patterns, (5-spots or 7-spots) are designed, so that driving energy can be applied against them. As the general tendency in all abandoned wells is to gradually close through natural caving, only a few will require treatment other than close observation after pressures are built up in the sand around them. Abandonments found to be leaking, either into thief formations, or to the surface must be re-opened, and the bore sealed off below the point of pressure escape. Operators, lacking adequate knowledge of old abandonments, often find it impossible to determine pressure-leakage of this nature, and unless the site of the offending well is identified, little or nothing can be done to overcome the trouble. Not only energy, but oil also is wasted through undetected wells.

Each abandonment recorded on a survey map serves initially as a detector, helping trace and identify sand boundary margins, water zones, gas caps, formation faults, and areas where the pay is non-productive or entirely absent. Considerable guesswork is thus eliminated, fewer dry holes are drilled, and new wells can be located in more productive areas. Later, as secondary recovery measures begin, the survey map becomes especially valuable as a reference, not only in planning pressure-patterns, but in identifying sand characteristics that lead to better control of flood energy. Controlled energy means fewer 'problem' wells. The record-book history that supplements the survey map of old abandonments, often reveals mistakes in shooting practices, faulty methods of seating casing, poor pumping technique, etc., that can be avoided in the operation of new wells. All these factors tend to conserve labor and materials, and conservation anywhere within the operating schedule lessens the expense of producing oil.

* * *

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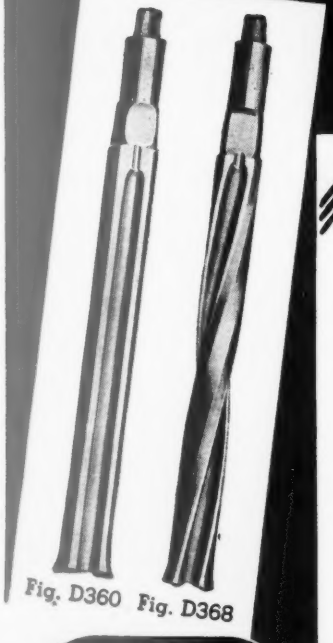

Fig. D360 Fig. D368

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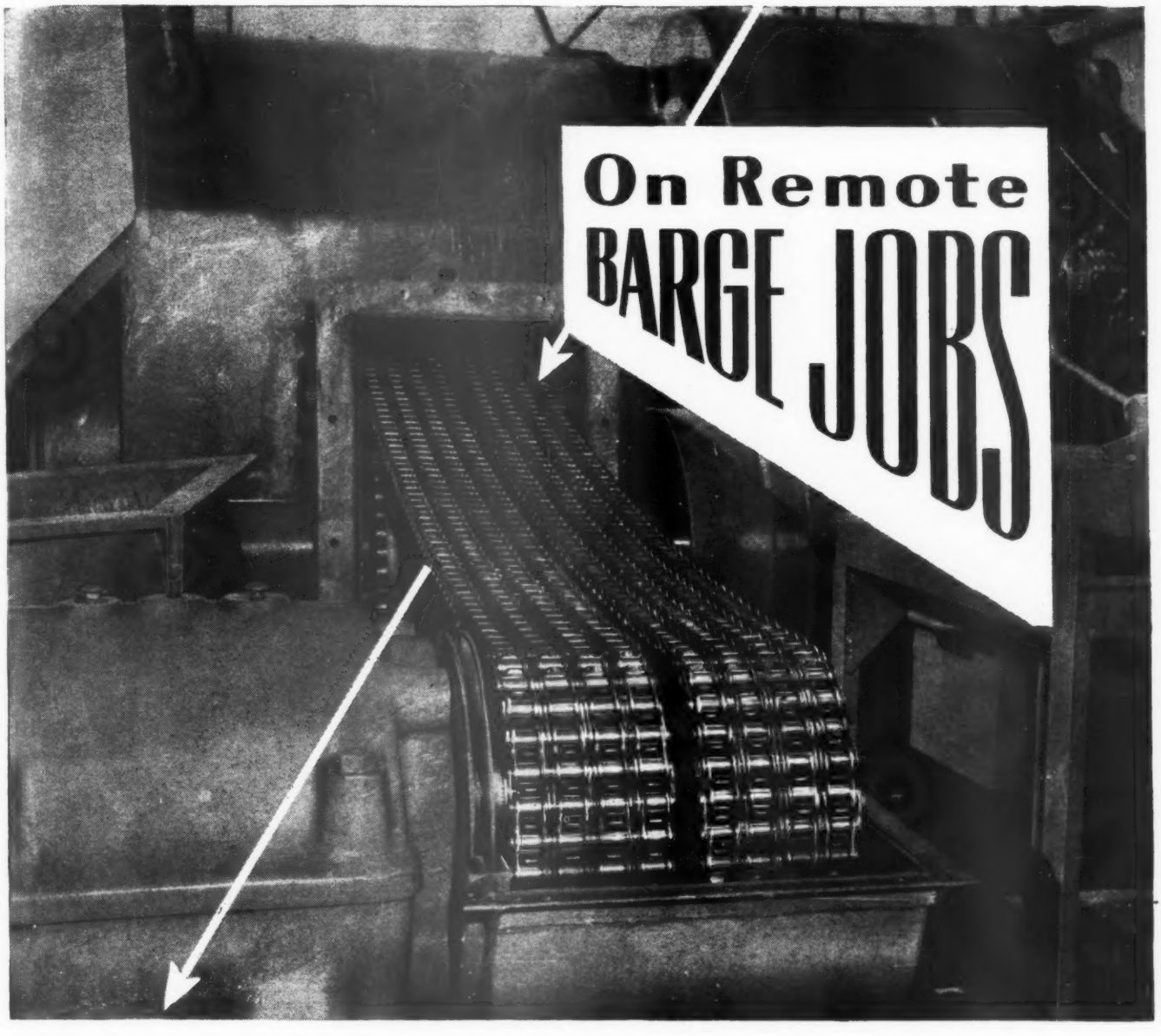

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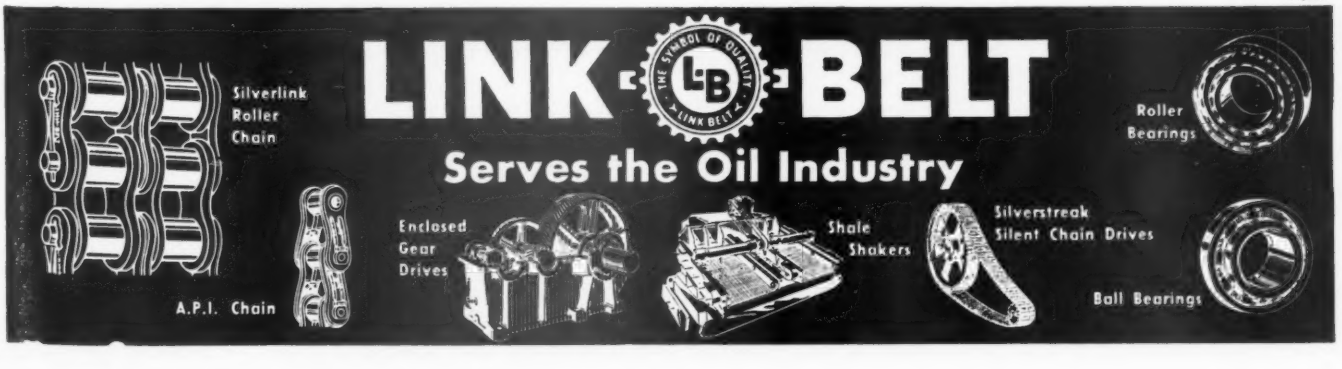

EXCLUSIVE

Who Were These Pioneers?

By HARRY BOTSFORD, Author of "Valley of Oil"

THE oil industry has never been able to go to a bookcase and pull out a volume that had all the answers in it. It has been too busy to write many books. It has had to do its own pioneering.

The names of many of the men who contributed to the growth of the industry are known, and their contributions are correctly appraised by this generation. When we speak of Drake, Roberts, and Kier, the industry and the world automatically associates them with their accomplishments and contributions.

But, the names of a literal host of pioneers who contributed importantly to the progress of the industry are lost. They were little men, the unknowns who had a talent for grabbing a mechanical problem by the ears and throwing it for a loss.

Mostly, they were a lot of grease-stained guys in a helluva hurry. Necessity and urgency pressed and heckled them during their working hours. They found, when they entered the oil industry, that their work was more than manual labor. It also called for thinking and initiative to implement the physical effort involved. That combination set oil men apart from the men who worked at plumbing, carpentry, painting, mechanical engineering, blacksmithing, and the like. A good oil field worker soon discovered that he had to use all these trades in his daily stint of work. Often, the boss didn't know the answers, either. Between them they faced emergencies, came up with the right answers in a high percentage of instances. Trial-and-error, with a minimum of the latter, became their working creed, and it hasn't changed much since the early days.

Who invented the siphon used in many oil fields to draw off salt water before it is pumped to the stock tank? It is just a simple little gadget made of 1 or 2-in. pipe, some connections—but, it is automatic, dependable, and easily installed. The oil and water emerge from the well through the lead line into a barrel or small tank. When the liquid level reaches a certain height, salt water begins to discharge through the siphon and the pure oil in the container is discharged to the stock tank. It is a nice, foolproof instrument. Time was when a pumper had to scuttle from derrick to derrick, knocking out wooden plugs and letting the salt water escape. Speaking from experience, this is not enjoyable in zero weather. Who invented this arrangement? No one knows, but the oil industry should erect a monument to his memory.

Who invented the pumping jack? Time was when each oil-producing well was pumped by an individual power plant, usually a steam engine and boiler. Obviously, this was expensive. The situation became acute when the price of coal and boiler wood zoomed at a time when the price of crude oil was at a low level. Also, the average well didn't produce enough oil to fire the boiler, even had they been equipped with burners.

Some genius—and he was a real genius, believe me—came up with a scheme for the multiple pumping of a number of wells from one central power plant. Such a mechanical innovation would save fuel and operating costs, but the mechanics were just a little on the difficult side: It included many factors aside from the use of the pumping jack. First of all, the unknown genius had to devise some way of transmitting power from the central power plant to the individual oil wells. It was done in a very simple manner. A bandwheel was placed in a horizontal position, attached to the steam engine by an endless belt. Jack lines or pull rods, usually made of oak, in 20-ft lengths, strapped together with iron clamps, were then attached to the crank of the bandwheel. That fetched a back-and-forth power to the well. Then the genius made a wooden pumping jack of heavy timbers, a device that rocked up and down and actuated the pumping apparatus of the well. It was a crude but effective way of transmitting power and putting it to work. Old-time oil men—of whom I am one—still speak with considerable heat when they recall the difficulties of repairing a broken rod line.

Multiple production methods have reached a point today where as many as 50 oil wells are pumped from a single power plant. In essence, what is used today is a series of refinements on the pioneer methods originated in the Pennsylvania oil fields when it came right down to a question of coming up with the right answer or abandoning thousands of oil wells.

Today's multiple pumping plants are models of good housekeeping; the power plant may be a powerful gas or diesel engine or a quiet electric motor. The geared equipment functions smoothly, the power transmission lines are of steel, as are the pumping jacks. A single pumper can handle the operation of an entire lease, and do it with efficiency and economy.

The fortune made by Roberts on his monopoly of "shooting" oil wells would have faded into insignificance if the man who invented multiple well pumping had patented his process and earned royalties on every installation. But, he completed his task, probably found himself confronted with another, neglected to protect his rights.

Many young engineers look upon some of the industry's crude engineering and hold their noses. Many of the mechanical short-cuts are unlovely, cumbersome. But, the young engineer soon finds that they are practical, basically sound.

No one knows to this day who invented the modern packer, the device that is lowered down a drilled hole or casing, and that is designed to shut off the flow of water at a certain level. Time was when oil producers used a seed bag, which was lowered into place. The water made the flax seeds in the bag swell tightly against the walls of the casing and the drilled hole, sealed the area effectively. It didn't always work, however, and its lasting qualities were none too good. Then the unsung genius appeared again and came up with a magic contraption made of rubber and steel that could be maneuvered into precise position and snugly installed. It not only worked, but it lasted. Again, the job was done by a man in a hurry, who wasn't concerned in patenting a device that has been vital to the production of crude oil.

Cable-tool drilling of today still retains virtually every mechanical factor that was originated by the oil industry and used when the Oil Creek valley was drilled in the sixties. True, the walking beam and bullwheel were used for the drilling of artesian water wells. But, the sand reel, the bull wheels, the tug rope, the temperscrew, and the engine telegraph stemmed largely from men of the oil industry.

There was once a wooden derrick at every oil well, another expensive

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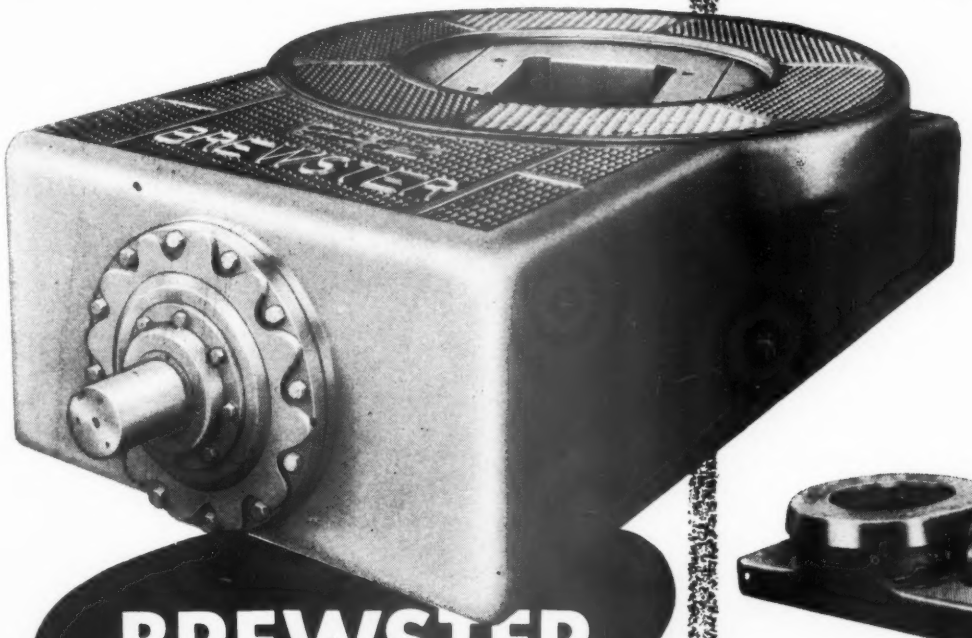

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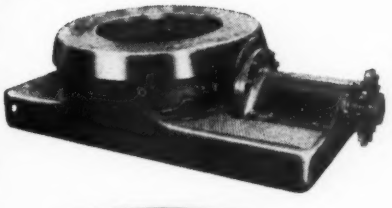

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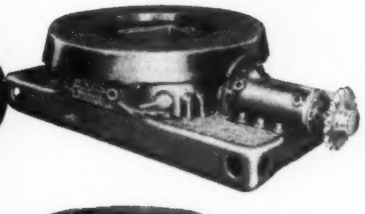

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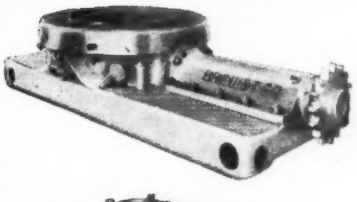

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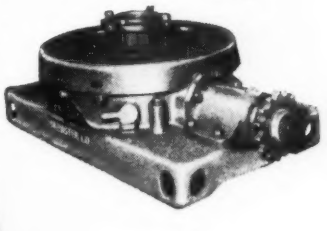

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item. Someone discovered that a tall, single pole was all that was needed to service the pumping well. Another genius came along and proved that it was unnecessary to tear down a derrick to move it to another location. He put rollers or wheels under the derrick foundations and hauled the structure where it was needed. Another economy, one that became more important with the introduction of the steel derrick.

Deep into the nineties the oil industry still lubricated its steam drilling and pumping engines with tallow. The steam entered the cylinder or chest after passing through the tallow. This was believed to be the only proper way to lubricate the engines. Then some unorthodox driller began to use lubricating oil, fed into the cylinder from an oil cup on the top of the cylinder. Old time oil men protested vigorously, claimed that the cylinders would be hopelessly scored. They were dumfounded that a petroleum lubricant made it possible to avoid the fatty acids generated by animal fats, that it functioned perfectly. On this advancement, the oil industry deserves only an assist. It was something the railroads had already discovered —but it was an oil refiner that convinced the railroads in the first place.

Progress in the mechanics of drilling, producing, transporting, refining, and distribution of petroleum has never been static. Never has an industry been bedeviled by more problems, most of them of a pressing nature. Solve or sink, improvise or perish—that has been the traditional status encountered by the petroleum industry.

Whipping the big and little problems, taking each in stride, has bred a lusty race of oil men. It has bred men who can work with their hands and their heads.

The industry still has its pioneers. Scarcely a month passes that a dramatic and workable solution is found for some problem that looks unbeatable. It may be shooting marbles into a clogged oil sand; it may be a system of "slugging" in a modern repressuring operation. Someone finds the answer, puts it to work, stands up, wearily wipes his brow and says defiantly: "Where in hell is the next problem?"

The chances are that he won't have to wait very long for its appearance.

* * *

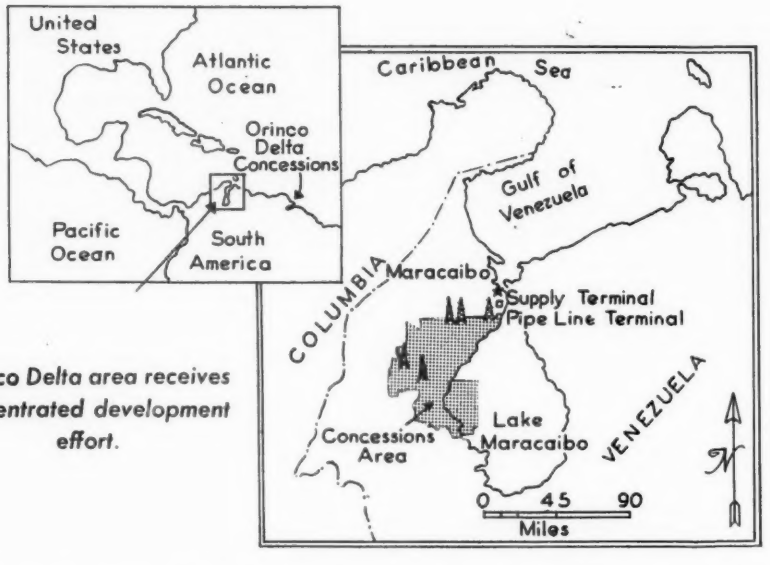
INTERESTING NEW DISCOVERIES IN VENEZUELA

RECENT discoveries of oil in Venezuela by Richmond Exploration Company, wholly owned subsidiary of Standard of California, have proved of sufficient importance to justify a large program of commercial development. Plans for producing, transporting, and marketing oil from these new reserves are already being carried into effect.

The discoveries are the result of intensive exploratory efforts in Venezuela by Richmond during the past four years. They are of particular significance in view of the rapid rise in the consumption of oil products, and the need for increased Western Hemisphere oil supplies. Activities in Venezuela were undertaken in anticipation of such a need and have involved a considerable investment.

Richmond Exploration Company in 1944 obtained exploratory concessions from the Venezuelan government to large acreages in two regions—the west side of Lake Maracaibo and the Orinoco River delta country. Selection of areas for further investigation and development has now been completed, comprising 885,818 acres adjacent to the lake, with some submerged blocks, and 421,197 acres in the Orinoco delta.

The most advanced exploratory work thus far has been in the Lake Maracaibo area, where several discoveries have been made. The development program is being concentrated at the outset on one discovery, known as the Boscan field, with the object of having crude oil available at tidewater on Lake Maracaibo by the end of this year. The Boscan oil is a heavy crude, primarily suited for fuel oils and asphalts. Six of the seven wells drilled there to date are producers. Additional wells are in progress.



Orinco Delta area receives concentrated development effort.

Plans are under way for an 18-in. pipe line to extend about 25 miles from the field to a terminal on Lake Maracaibo, where oil will be delivered for shipment by water.

Substantial oil bearing formations have been found in four other parts of the Lake Maracaibo concessions, although their full importance has not yet been ascertained. A well situated about seven miles west of the Boscan field, on a separate structural feature, encountered heavy oil similar to the Boscan crude. Wells at two points in the west central part of the concessions resulted in evidence of extensive reserves of oil. One of the wells on initial tests, produced considerable amounts of 33 gravity oil from limestone formations which are the same as those in prolific producing fields, not far from the Richmond Exploration Company's holdings.

Another well between the Boscan field and the lake has brought in heavy flows of high pressure gas and distillate. Several other localities where exploratory work has been done within the Lake Maracaibo concessions are regarded as favorable for the ultimate development of crude oil production. In the Orinoco delta region, geological and geophysical reconnaissance has been completed and additional exploratory activities are being planned.

Richmond Exploration Company has headquarters at Caracas and an operating division office at Maracaibo. A personnel recruiting and materials purchasing office has been established in New Orleans.

* * *

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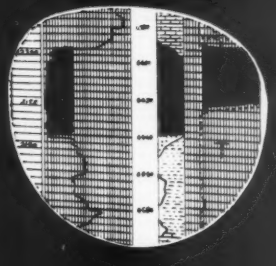

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Measurement of mud viscosities at high temperatures*

By V. N. Bednarski†

● **Abstract.** Structural details and method of operation of a torsional, variable speed, laboratory viscosimeter for the measurement of mud viscosities up to and including 200 F at atmospheric pressure are presented.

Typical temperature-viscosity effects on a number of different clay muds are illustrated to indicate the possible effect of high temperature formations on drilling muds.

The results obtained show that most clay muds develop an increase in viscosity at temperatures above 160 F when

*Presented before the Spring Meeting of the Pacific Coast District, Division of Production, American Petroleum Institute, Los Angeles, California, May 6-7, 1948.

†The Texas Company, Technical Service and Research Laboratories, Producing Department, Pacific Coast Division, Signal Hill, California.

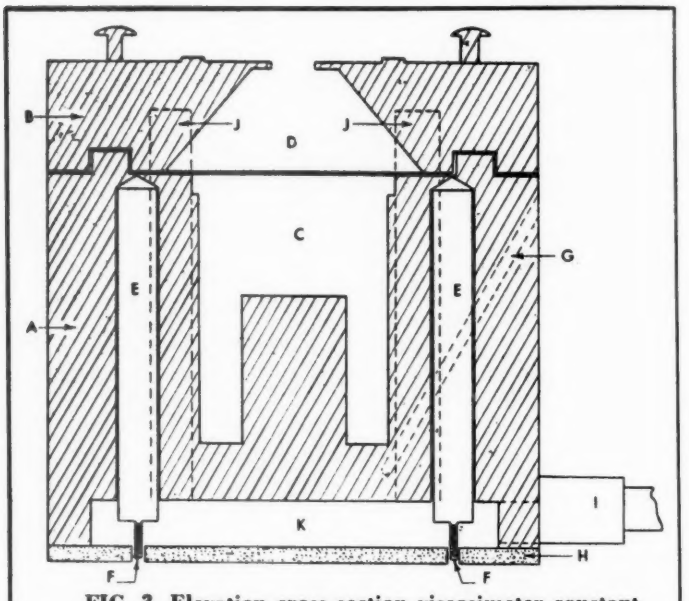
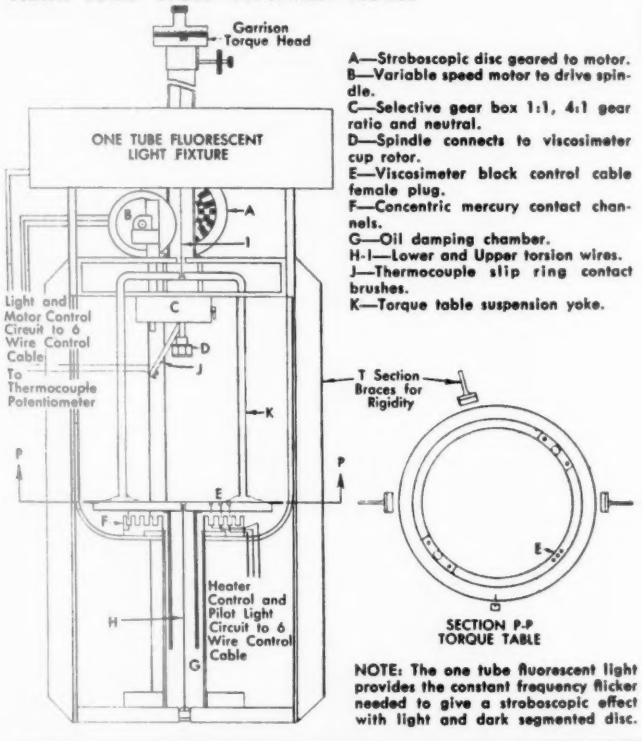


FIG. 3. Elevation cross section viscosimeter constant temperature block high temperature viscosimeter.

A—Solid Aluminum Block Machined to Dimensions.
B—Solid Aluminum Cover—(Split).
C—Cavity for Sample Cup.
D—Cavity in Cover for Mercury Seal.
E—Adjustable Cartridge Thermostats.
F—Thermostat Adjusting Screws.
G—Thermometer Well.
H—Transite Board.
I—Control Cable Plug.
J—Cartridge Heaters, K Cavity for Wiring and Thermostat Selector Switch.

FIG. 1. High temperature viscosimeter stand semi-cross-sectional views.



A—Stroboscopic disc geared to motor.
B—Variable speed motor to drive spindle.
C—Selective gear box 1:1, 4:1 gear ratio and neutral.
D—Spindle connects to viscosimeter cup rotor.
E—Viscosimeter block control cable female plug.
F—Concentric mercury contact channels.
G—Oil damping chamber.
H-I—Lower and Upper torsion wires.
J—Thermocouple slip ring contact brushes.
K—Torque table suspension yoke.

NOTE: The one tube fluorescent light provides the constant frequency flicker needed to give a stroboscopic effect with light and dark segmented disc.

A CARTRIDGE HEATERS PROTRUDING INTO COVER.
B THERMOSTATS IMBEDDED IN BLOCK.
C THERMOMETER WELL.
D THERMOSTAT SELECTOR SWITCH-4 POSITION.
E CONTROL CABLE THAT PLUGS IN ON TORSION TABLE.

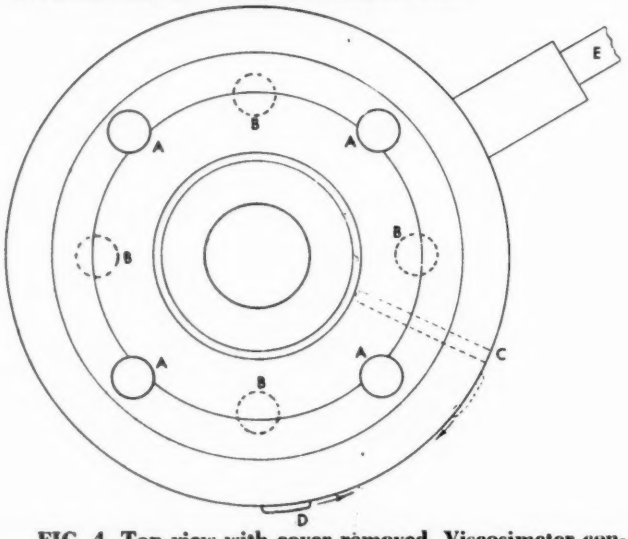
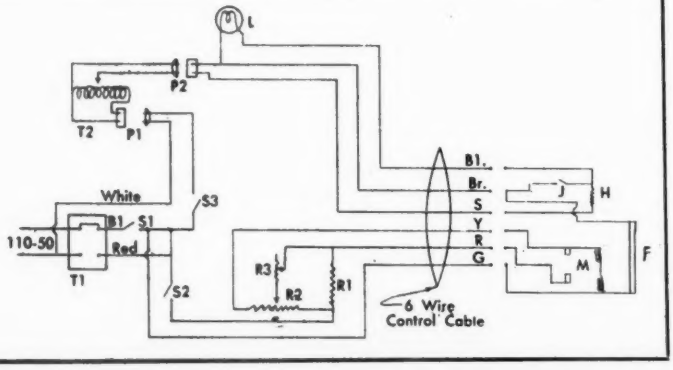
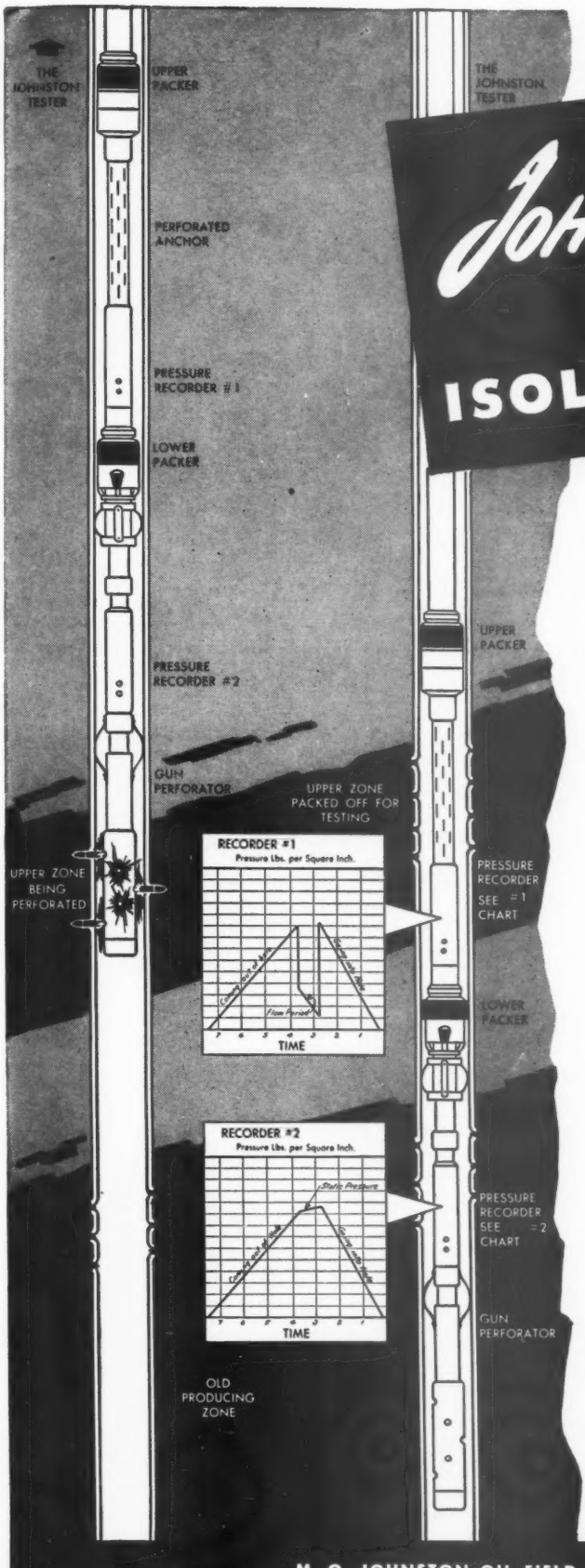


FIG. 4. Top view with cover removed. Viscosimeter constant temperature block high temperature viscosimeter.

FIG. 2. Schematic wiring diagram of high temperature viscosimeter control box.

T1—Sola constant voltage transformer.
S1—Master and light switch.
S2—Motor switch.
S3—Block heater current switch.
R1—Fixed motor speed control resister—500 ohm.
R2-R3—500 and 5 ohm coarse and fine motor speed control rheostats.
T2—Variable autotransformer to control power to block heaters.
P1-P2—Polarized plugs so that autotransformer may be removed from circuit.
L—Block heater pilot light.
H-J—Block heater and thermostat (only 1 of 4 sets shown).
M—Variable speed motor to drive spindle.
F—Fluorescent Light.





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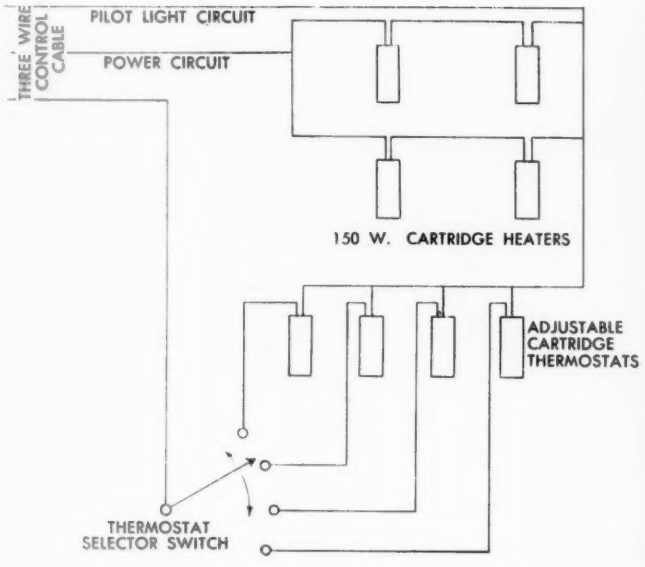

FIG. 5. Schematic wiring diagram viscosimeter constant temperature block.

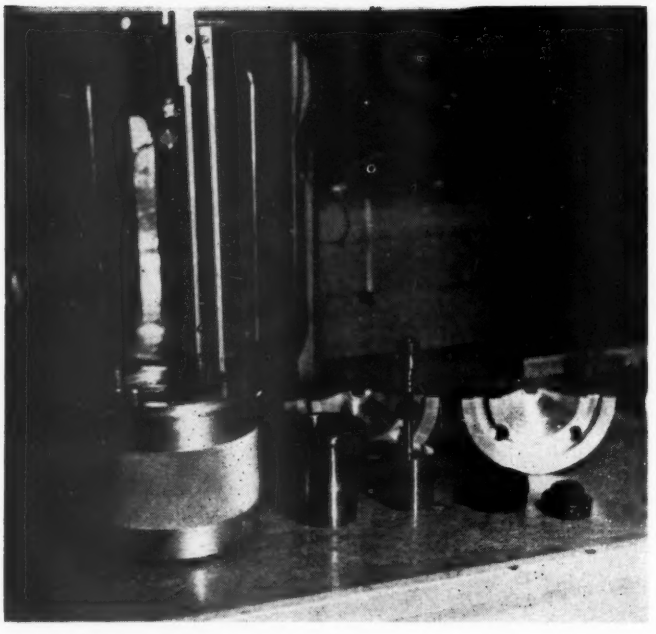

FIG. 7. Viscosimeter block assembly. Left to right: Constant temperature block, sample cup, rotor, mercury seal trough, mercury seal cap; two mercury seal heating blocks at back.

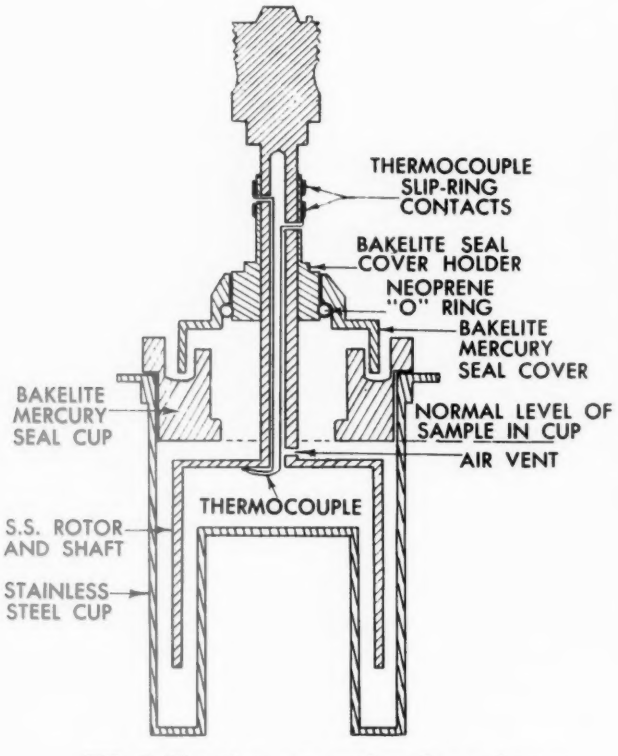

FIG. 6. Elevation cross section. Cup and rotor assembly high temperature viscosimeter.

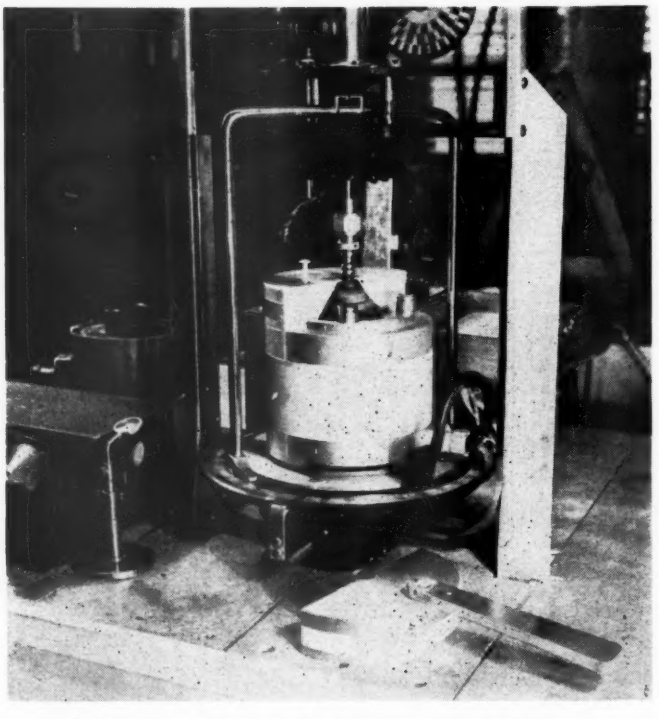

FIG. 8. Viscosimeter block on torrue table. Showing details of the mercury seal heating segments.

subjected to rates of shear of less than 600 rpm.

● **Introduction.** The abnormal behavior of drilling muds in wells drilling through high temperature formations and the general tendency toward higher temperature with increased depth of wells made it desirable to study the effect of high temperatures on the viscosity of muds in the laboratory.

As commercial instruments for this purpose were not available it was necessary to design one for the specific purpose. The viscosimeter was already in the process of construction when the present writer was assigned to complete the instrument and was fortunate enough to overcome the basic stumbling block—evaporation of water from the sample.

● **Stroboscopic high temperature viscosimeter.** Basically, the instrument is a torsion type viscosimeter in which the torque, transmitted from an inverted rotating cup through the sample to a concentric stationary cup, is proportional to the viscosity of the sample. The general construction is patterned after an early type of Garrison viscosimeter.[1]

The rotating cup speeds are controlled by selective gear reduction and variable speed motor. The speeds are registered by a stroboscopic disc on the driving motor. This provides six speeds, 800, 600,

1. "A Study of Some Phases of Chemical Control in Clay Suspensions." A. D. Garrison and Ten Brink, *AIME Transactions.* 136, 175 (Tech. Pub. 1124, 1940).

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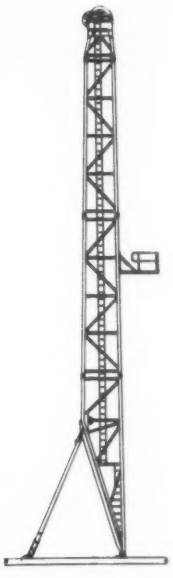

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98 Ft. High
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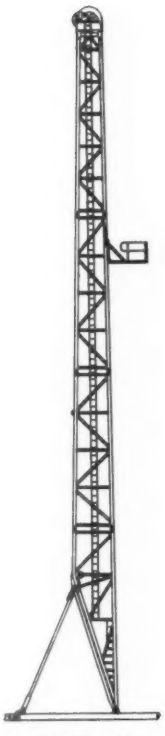
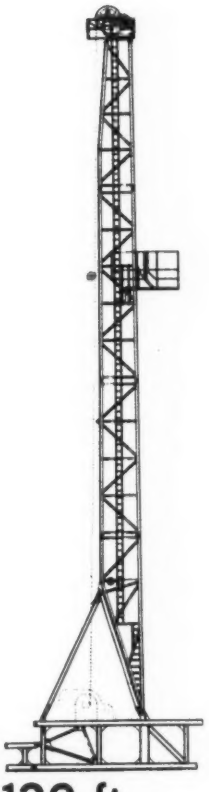
4-½" Drill Pipe—99 Doubles



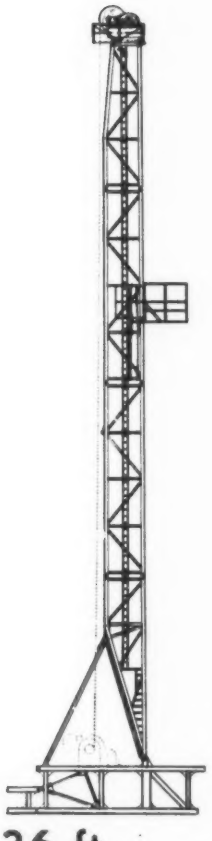
127 ft.

127 Ft. High
Capacity 450,000#
Top Size 4'-0" x 4'-6"
Width of Skid Base 18'-0"
Racking Capacity—
4-½" Drill Pipe—99 Trebles



129 ft.

129 Ft. High
Capacity 563,000#
Top Size 4'-3" x 4'-10"
Width of Substructure 26'-6"
Racking Capacity—
4-½" Drill Pipe—99 Trebles
5-9/16" Drill Pipe—70 Trebles



136 ft.

136 Ft. High
Capacity 830,000#
Top Size 4'-6" x 5'-10"
Width of Substructure 26'-6"
Racking Capacity—4-½" Drill Pipe—158 Trebles
5-9/16" Drill Pipe—133 Trebles

Heavy Series

The 129 Ft. and 136 Ft. Heavy Series Drilling Masts have been especially designed to meet the demands of deeper drilling. They are regularly furnished with a 9 Ft. high x 26'-6" wide substructure having a 12 Ft. clear cellar span. Substructures to other specifications are available, designed and built to suit special conditions.

400, 200, 150, and 100 rpm, giving a wide range of rates of shear so that thixotropy or gelling of the mud may be indicated by its apparent viscosity at the different rates of shear. A number of variable speed viscosimeters have been described in literature but none, to the writer's knowledge, that can be operated for extended periods of time at substantially elevated temperatures. Structural and electrical details are shown in Figs. 1 to 6.

In order to operate such an instrument at high temperatures two essential features are necessary: (1) A means to heat the sample to, and maintain, a given temperature, and (2) a device to prevent evaporation of water from the sample. The obvious method using a thermostatted bath and an ordinary mercury seal proved a failure, for although the mercury seal provided a diffusion barrier to escaping water-vapor, the temperature of the seal was lower than that of the sample so that water condensed and was eventually thrown out by centrifugal force past the shallow mercury seal. It was only after repeated attempts to stop a persistent leak that the above conditions came to light.

An experimental heater for the mercury seal proved effective in preventing condensation and loss of water from the system as evidenced by the fact that mud viscosity on a trial sample held constant for over three hours after reaching equilibrium at 120 F. The final design of the constant temperature unit in current use was based on the above findings. In several months of intermittent operation no loss of water from the mud samples has been experienced.

The unit, whose details are shown in Figs. 3, 4, and 5 was machined from a solid piece of 6-in. aluminum extrusion ingot. The four cartridge heaters imbedded in the block project up into the semi-circular, removable, mercury seal covers that maintain the seal at the same temperature as the sample. Between the heaters are imbedded four thermostats each adjustable from the bottom to a desired temperature. A selector switch in the bottom provides quick change from one temperature to another by changing thermostats. The sample cup in the center fits snugly for better heat transfer but is removable for washing. A thermometer well in the block makes possible a continuous temperature check on the thermostats.

● **Operation of viscosimeter.** Steps in the operational procedure of the viscosimeter are as follows:

Fig. 7 shows the viscosimeter disassembled prior to testing a sample of mud. The units, left to right are (1) constant temperature block; (2) sample cup; (3) rotor; (4) mercury seal seat, and (5) mercury seal cap. The two semicircular segments in the background are the mercury seal covers that maintain the seal at the temperature of the block.

The order of assembly is as follows: The sample cup with mud sample is inserted in the constant temperature block. The rotor is then placed in the cup containing the mud followed by the mercury seal and the mercury seal cap left loosely, not snapped in place, over the "o-ring" on the rotor. The unit is now ready to be placed on the torsion table where the rotor is clamped onto the spindle, the mercury seal cap snapped in place, and the electric control cable plugged in. Two pins on the table, matching recesses in the block, assure positive alignment of the rotor and spindle. The semi-circular segments that just clear the mercury seal and the shaft are next in order to be followed by a thermometer as a check on the operation of the thermostats. One segment is shown in place in Fig. 8 and the completed assembled unit, ready for operation is shown in the succeeding Fig. 9.

To avoid any irreversible temperature effects on the mud a series of temperature-viscosity determinations is always started at the lowest temperature. The thermostat selector switch, barely visible at the base of the constant temperature block, is set on Position 1, corresponding to 80 F (No. 2—120 F, No. 3—160 F, No. 4—200 F). To limit the power input to the heaters a Variac transformer is used. The lower left-hand toggle switch turns on the power to the unit and lights the fluorescent lamp that provides the stroboscopic illumination. The pointed switch between the pilot light and speed control dial activates the heater thermostat circuit, while the upper left-hand toggle switch controls the motor current. By means of the speed control potentiometer[2] the speed of the motor is adjusted to 800 rpm on the spindle. This is indicated when the inner stroboscopic circle becomes stationary.

The mud sample is brought to temperature equilibrium at 800 rpm before

[2]The motor speed control circuit shown is covered by an Ohmite Manufacturing Company patent.

FIG. 9. The viscosimeter assembly ready for operation.

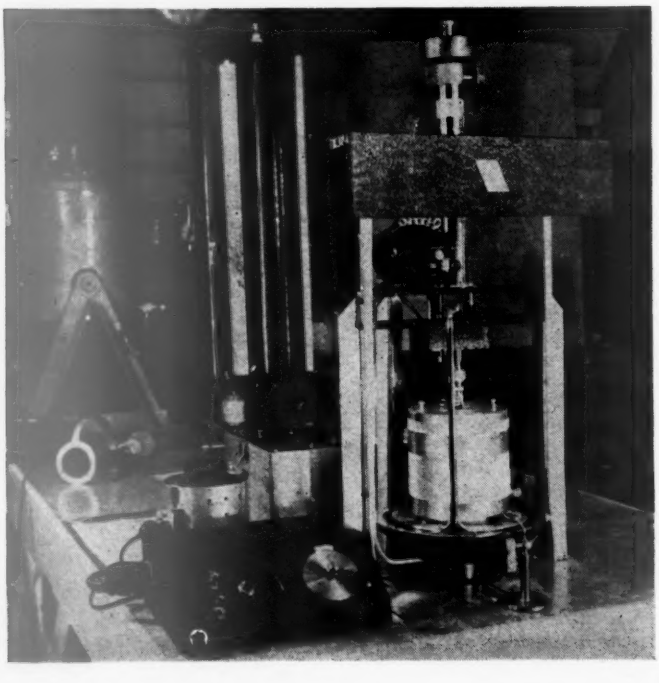
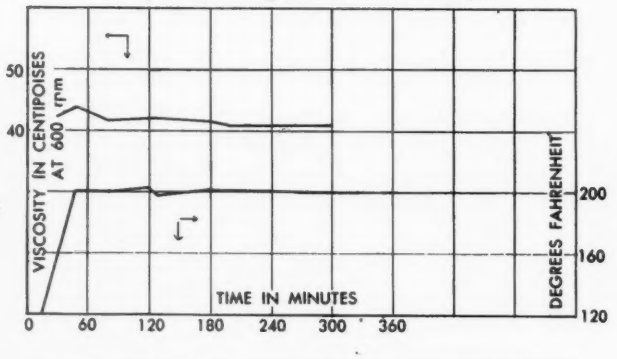


FIG. 10. Time-temperature stability of a temperature stable clay.



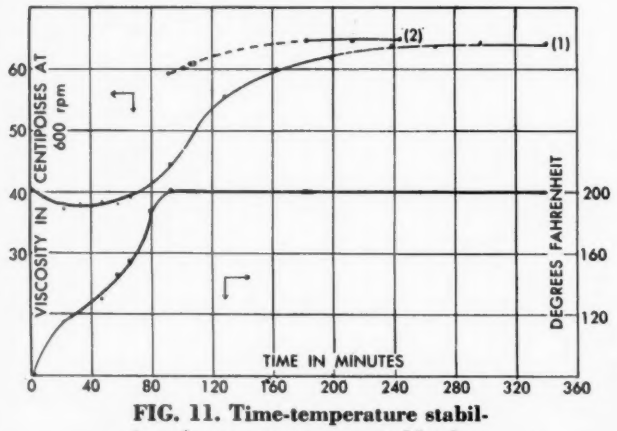


FIG. 11. Time-temperature stability of a temperature unstable clay.

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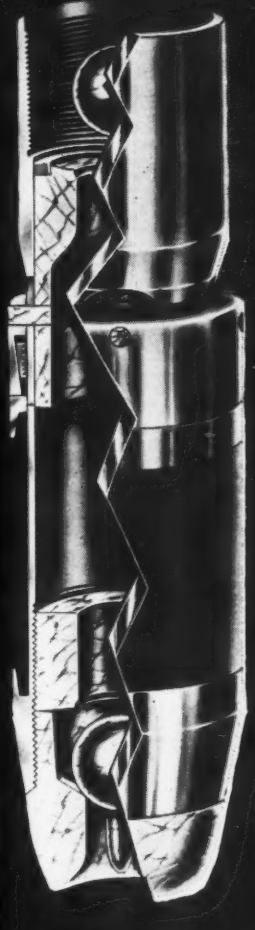

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Cut-away view of Larkin CEMENTROL Shoe after being set.

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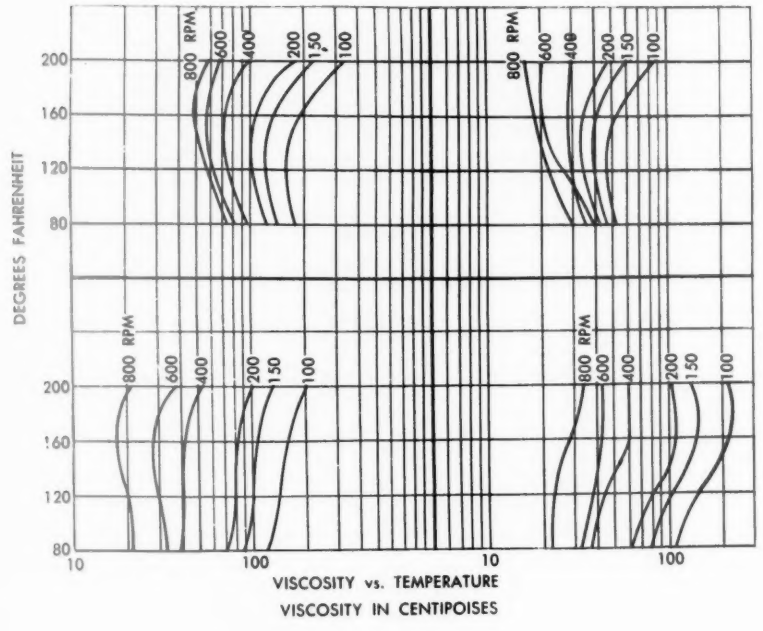


FIG. 12

taking a given set of torque readings at 800 and lower rates of rotation. Temperature equilibrium is indicated by a constant value of the rotor thermocouple on two readings at least five minutes apart. The temperature equilibrium having been established, a torque reading is made at 800 rpm by turning the torque head until torque table and stationary marks coincide. Because of a certain amount of inertia of the heavy block (12 lb) it is necessary to displace the table angularly so that it oscillates a little. If the marks coincide after the table comes to rest twice the torque reading is considered valid and the rotor is slowed to the next lower speed. For 600 and 400 rpm this is accomplished by slowing the motor until the middle then the outer stroboscopic rings, respectively, become stationary. For the 200, 150, and 100 rpm speeds a 4 to1 gear in the spindle is engaged and the motor again run at 800, 600, and 400 rpm stroboscopic speeds.

Each time the speed is reduced between determinations an interval of ten minutes is allowed for the mud to come to equilibrium before a torque reading is taken.

When the complete set of torque readings at a given temperature is completed the spindle speed is changed to 800 rpm and the thermostat selector switch changed to the next higher temperature throughout the system.

In order to speed the rate of heating between selected temperatures the Variac transformer is advanced to 110 or 135 volts until a temperature within 5 F of that desired is indicated on the block thermometer, the Variac is then adjusted to a satisfactory operating voltage that gives minimum fluctuation in the temperature of the block, thus 65 volts at 120 F, 85 volts at 160 F, 95-100 volts at 200 F.

The equilibria conditions described are obtained for each desired temperature until a complete set of rpm-torque data is obtained for each of the four temperatures.

In order to obtain comparable results it has been the practice not to interrupt a test run once an elevated temperature has been reached.

● **Calibration and sensitivity.** The instrument was calibrated at 77 F (25 C) by means of a series of secondary standard oils whose viscosities in turn were determined by Ostwald viscosimeters. The Ostwald viscosimeter constants were found by means of a number of primary standard oils supplied by the Beacon Laboratories of The Texas Company.

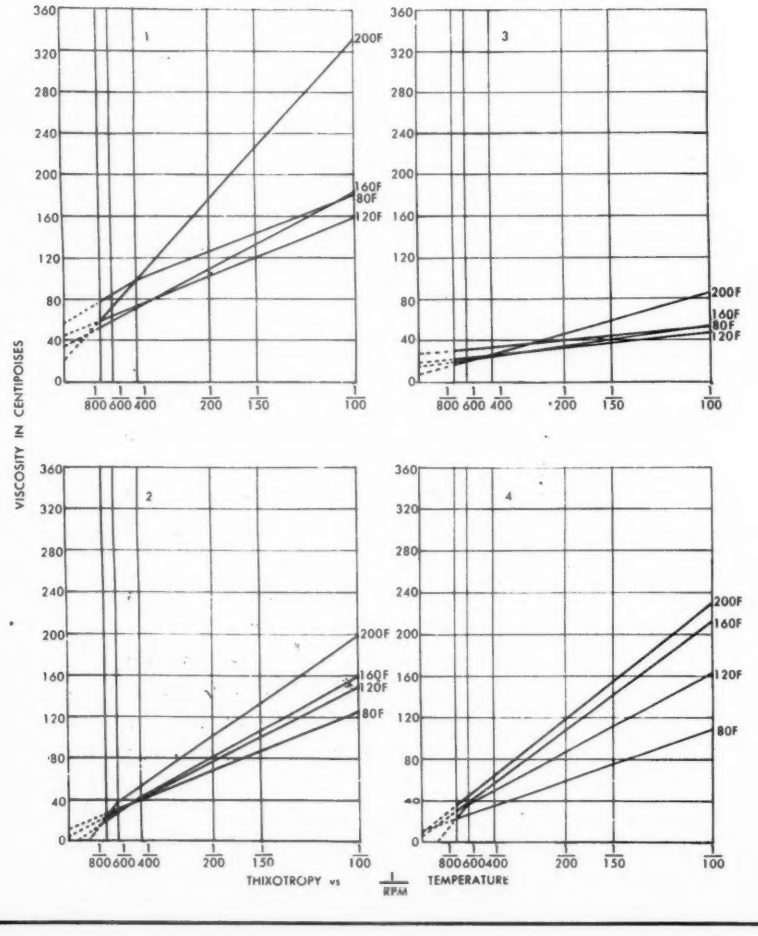
Due to the rather high weight of the constant temperature block it was necessary to use a larger diameter torsion wire than originally planned, so that in spite of the relatively long lengths its sensitivity is low in the higher viscosity and lower rpm ranges.

The torsion head has one hundred divisions and the vernier permits accurate torque determinations to one-tenth of a division. The ultimate sensitivity ranges of the instrument in terms of centipoises per tenth of a division are shown in Table 1 below:

TABLE 1. Sensitivity cpe per 1/10 div.

rpm	Minimum	Maximum
800	0.2	0.1
600	0.2	0.15
400	0.30	0.25
200	0.7	0.5
150	0.9	0.8
100	1.2	1.0

FIG. 13



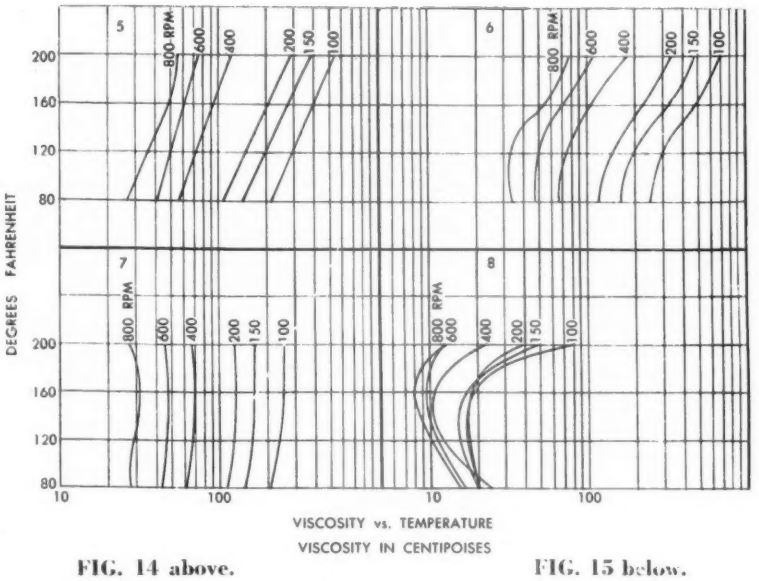
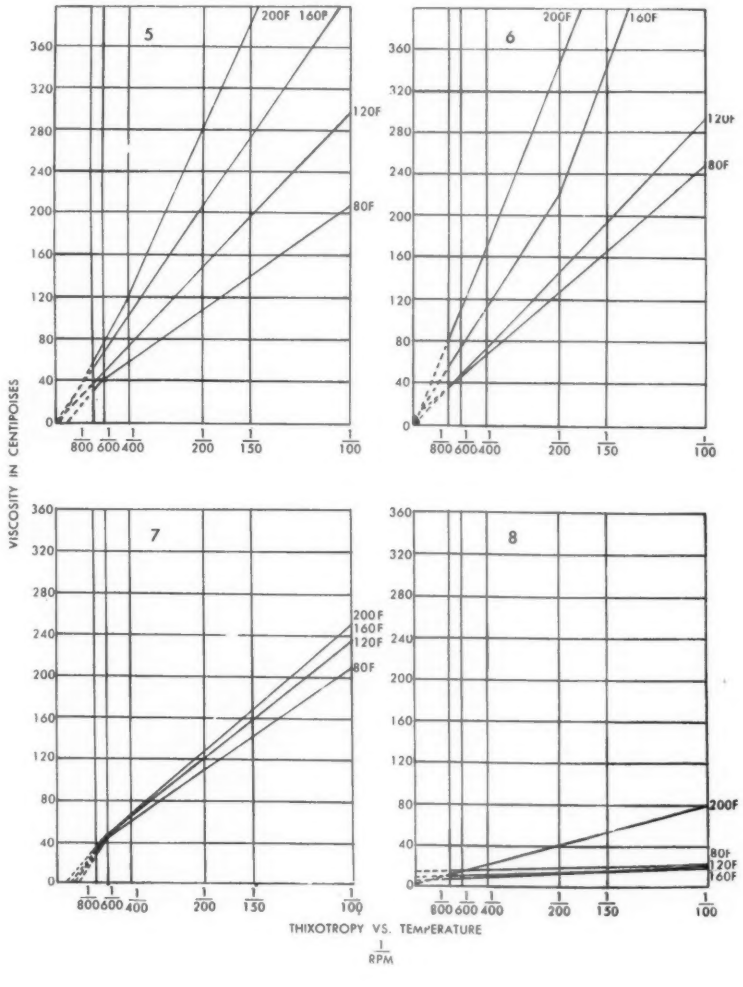


FIG. 14 above.

FIG. 15 below.



● **High temperature stability.** The stability of operation at high temperature and the time required to reach equilibrium may be demonstrated as follows: Fig. 10 shows viscosity and temperature curves for a relatively temperature inert clay over a period of five hours. The temperature curve rises rapidly to 200 F and remains constant. The viscosity curve fluctuates slightly then remains constant within experimental error for nearly 3½ hr. If any evaporation of water had taken place there would have been a steady rise in viscosity.

Fig. 11 shows the temperature and viscosity curves for a temperature unstable clay. Viscosity curve 1 shows the progressive changes in viscosity starting from 80 F as the temperature was raised to and maintained at 200 F. The continuous increase in viscosity after the block reached the desired temperature is not due to lag in temperature between the sample and the block but rather due to velocity of reaction of the clay to temperature. Tests have shown that the sample is at equilibrium temperature within ten minutes after the block reached the desired temperature. Again the viscosity levels off to a constant value above which it does not rise showing that evolution of water does not take place.

Viscosity curve 2 is another sample of the same mud and very nearly of the same base viscosity (within 2 centipoises) that had been put through the steps outlined in "Operation of the Instrument." Then after the 200 F determinations had been completed the temperature was left at 200 F and the sample stirred for 20 min at 800 rpm then dropped to 600 rpm for 30 min and the viscosity noted. The first point on the curve is that originally determined in the regular procedure. The second point is that noted after the 30 min noted above but actually some 90 min after the initial determination. The third and fourth points are further observations 30 min apart. The original determination was within five centipoises of the equilibrium value for this particular mud. Because clays differ in their temperature reaction velocities and because the normal operation of the instrument takes very nearly a full eight-hour day, the values obtained with the set procedure (in this instance 5 centipoises too low) have been taken as representative of the actual equilibrium viscosity.

● **Reproducibility of results.** The reproducibility of results may be illustrated by the following experiment. A bentonite mud was tested for viscosity characteristics at the six speeds at 80 F then left in the viscosimeter overnight. The following day the run at 80 F was repeated. Table 2 shows the comparative results obtained.

TABLE 2

Viscosity at (rpm)	800	600	400	200	150	100
Original (cpe)....	30.4	39.3	34.7	40.2	43.8	49.7
Second day (cpe).	30.1	39.3	35.2	42.4	46.7	53.0
Difference (cpe)..	0.3	0.0	0.5	2.2	2.9	3.3

The differences at the lower speeds are considerably in excess of the ultimate sensitivity of the instrument as shown in Table 1. It is believed that this is due primarily to the relatively high inertia of the constant temperature block. It also appears to be a function of the viscosity of the mud as it has been found difficult to obtain a torque reading within less than 0.5 divisions when the apparent viscosity of the mud at the lower speeds is in excess of 100 centipoises. At present it is felt that the reproducibility and accuracy of the instrument could be improved by refinements in construction and particularly in the reduction of size and weight of the constant temperature block.

● **Preparation of mud samples.** The mud samples were prepared by mixing clay and tap water in 3-gal glass pickle jars, with a variable Lightning mixer, to 45-50 sec API funnel viscosity 1500 cc in--1000 cc out. The samples were then allowed to hydrate overnight in an 80 F cabinet. The samples were then ad-

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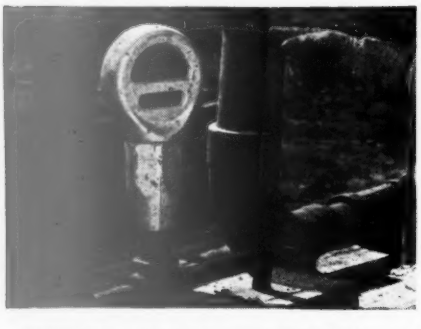

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FIG. 16

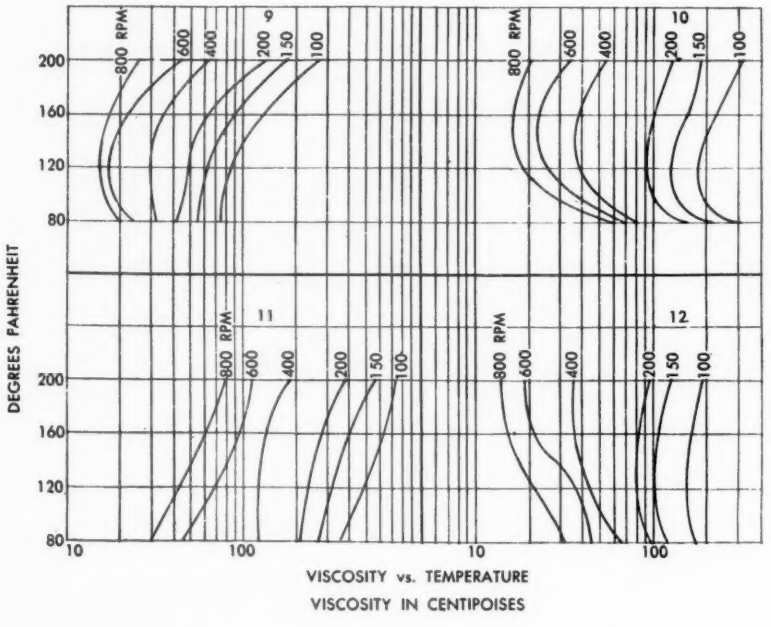

FIG. 17

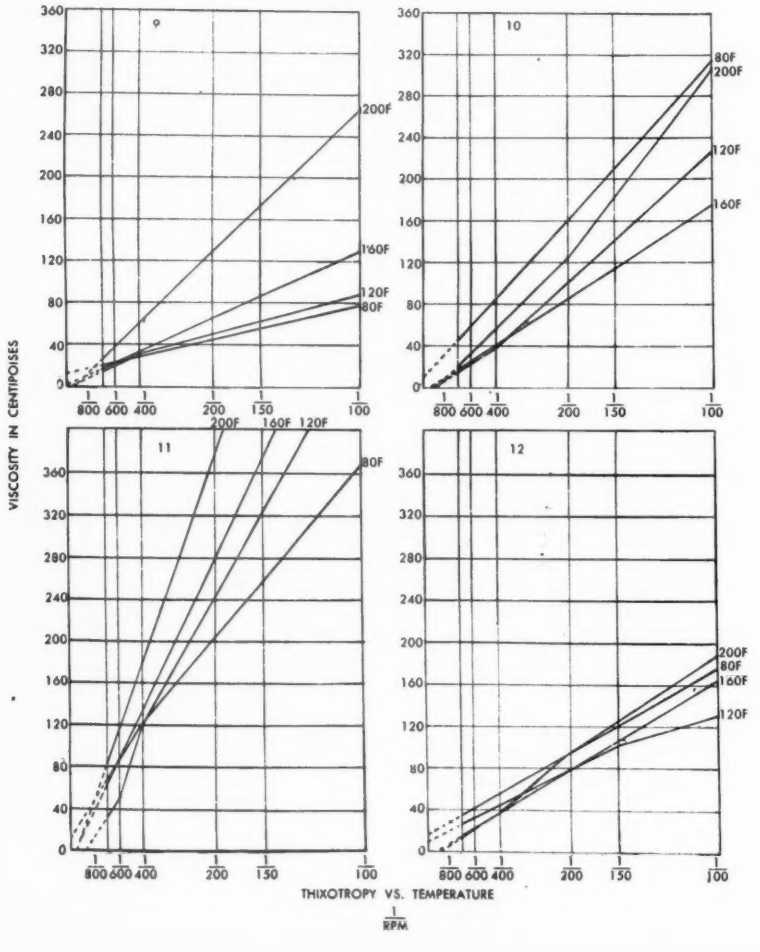

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FIG. 18

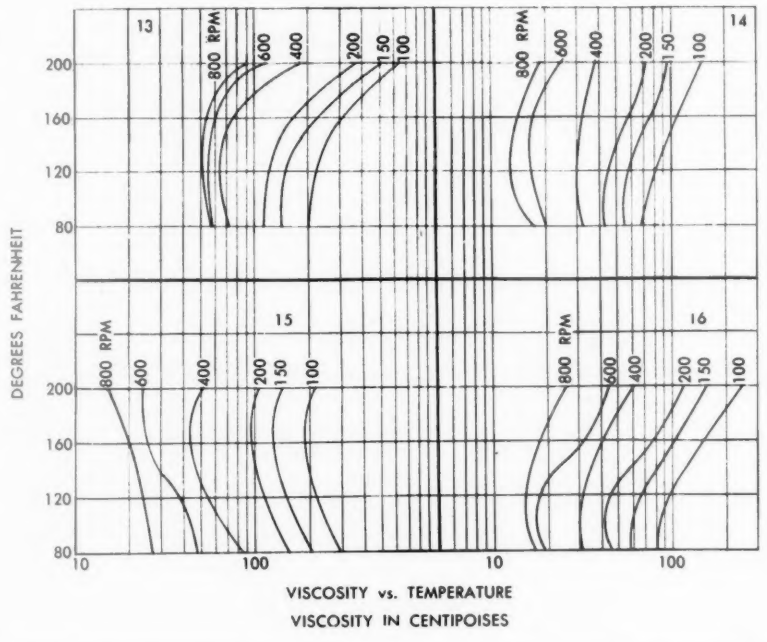
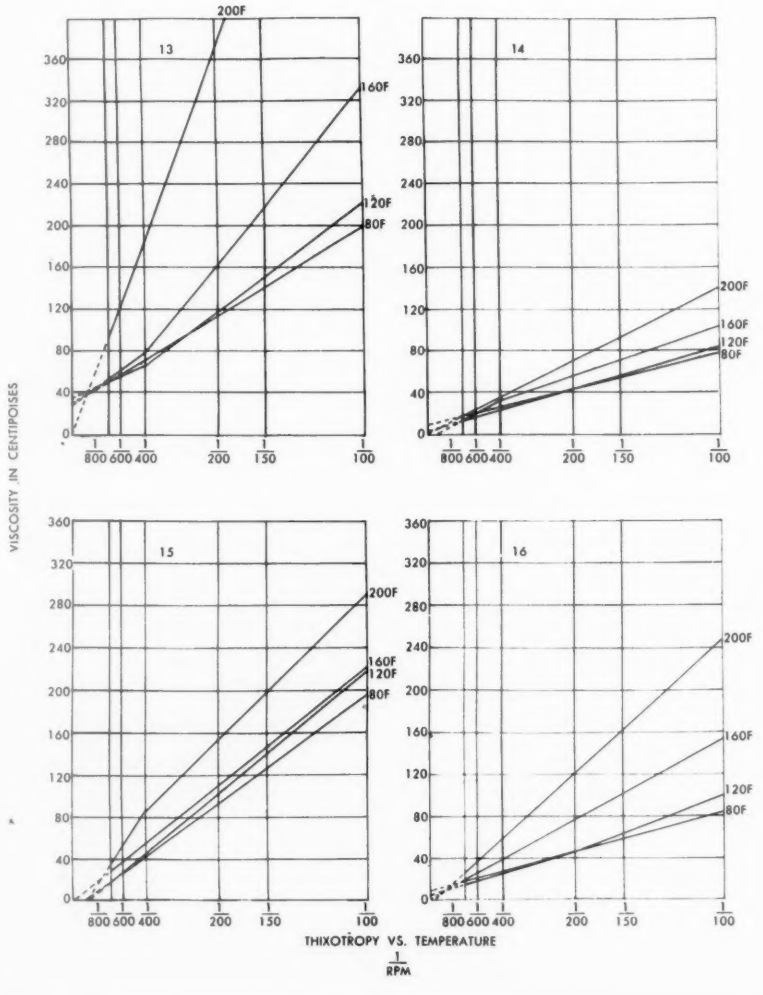


FIG. 19



justed with water, if necessary, to fall within 45-55 sec viscosity range. No further adjustments were made although some of the clay muds developed a higher funnel viscosity on further standings. The muds were thoroughly stirred with the mixer before removing samples for viscosity-temperature determinations.

● **Some temperature-viscosity results:** For convenience, the results, Figs. 12-19, are presented in four groups, four clays in each group. The first group is representative of clays making useful muds in the 65 to 69 lb per cu ft (8.7-9.2 lb per gal) range, the second includes those in the 70 to 77 lb per cu ft (9.4-10.3 lb per gal) range, the third from 78 to 85 lb per cu ft (10.4-11.4 lb per gal) and the last those whose normal weight exceeds 85 lb (11.4 lb per gal).

The graphical data are presented in two sets of curves. One set illustrates the change in viscosity with temperature at constant rpm, the other the change in viscosity with reciprocal of shearing rate or $\frac{1}{\text{rpm}}$ at constant temperature by the Garrison method.[1] The first set shows a straightforward temperature - viscosity relationship at various speed of rotation. Here the 600 rpm values may be taken to be equivalent to Stormer centipoise viscosities at 80 F they are known to correspond within a few per cent. The second set indicates the change in thixotropic or gelling properties with change in temperature.

Although the general form of the viscosity-temperature curves appears common to all, there is sufficient individual variation between clays so that some might be preferred to others in drilling operations where high hole temperatures are expected. Selecting the best base clay is not the whole answer but it is a step toward improved high temperature mud technology.

It is hoped that instruments of the type described here will materially assist those engaged in solving mud problems in the normal as well as the high temperature range.

● **Conclusions.** A torsional type, high temperature, viscosimeter (patterned after an early type Garrison viscosimeter) has been successfully operated to measure the effect of temperatures on mud viscosity up to 200 F at atmospheric pressure.

Typical temperature-viscosity effects on a number of clay muds are presented to indicate the possible effects of high temperature formations on drilling muds.

● **Acknowledgments.** The writer wishes to express his thanks to The Texas Company for permission to publish this paper; to R. L. Stamback of Stamback Instrument Laboratories for suggestions during the construction of the instrument; and to William W. Robinson, Jr., W. J. Weiss and A. C. Nestle of The Texas Company for their cooperation and assistance. Mr. Weiss initiated the design and construction of the instrument but was unable to see it through to completion because of other, more pressing, assignments.

* * *

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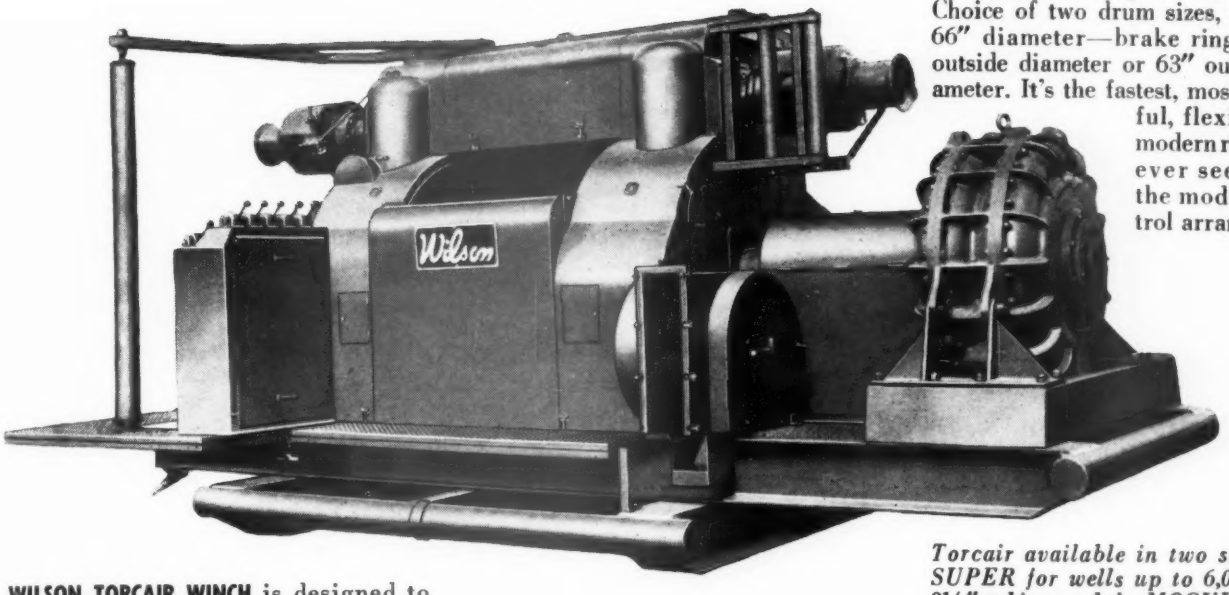

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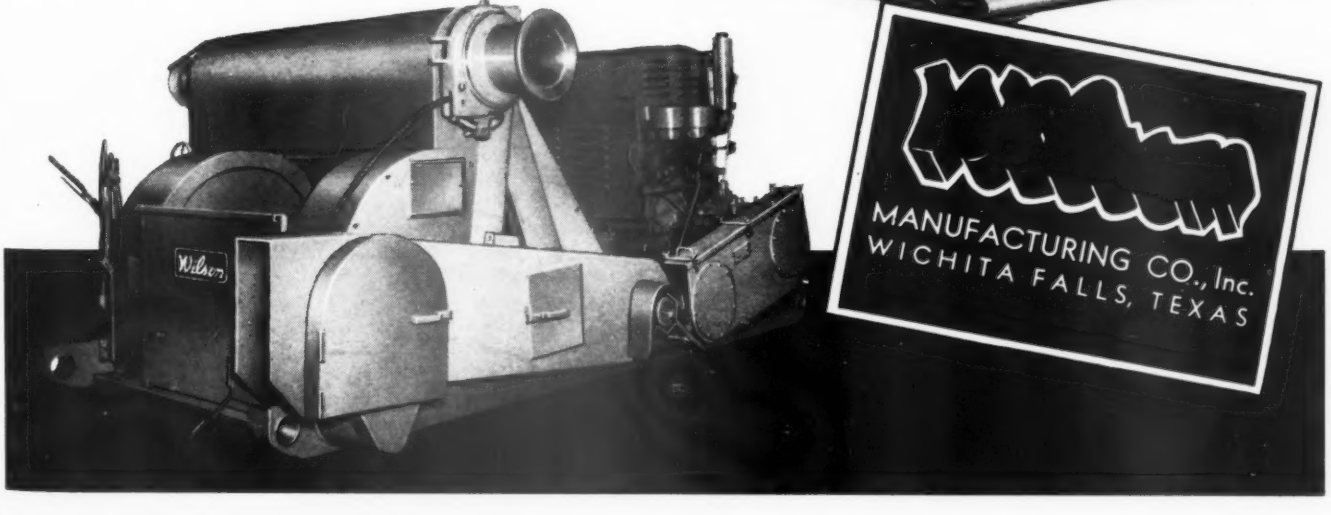

A Critical Review of Methods Used in the Estimation of Natural Gas Reserves*

By HENRY J. GRUY and JACK A. CRICHTON of DeGolyer and MacNaughton

Abstract. This paper discusses methods used in the estimation of natural gas reserves and the general conditions under which the various methods are applicable. The factors used in estimating natural gas reserves are reviewed. Errors that have been found to occur frequently are listed.

Introduction. The estimation of natural gas reserves has become of paramount interest because of the increasing importance of gas in the nation's economy. Gas is a most desirable fuel, a fact substantiated by the continued rise in the market demand. In addition, new uses for gas are being developed by the chemical, plastic, and associated industries, and plants are being built to make gasoline from natural gas. These are a few of the factors contributing to the importance of the nation's natural gas reserves.

With the increased importance of gas there is an increase in the need for reliable estimates of the magnitude and availability of natural gas reserves. These estimates are being used currently: (1) To determine which fields contain sufficient available reserves to justify the construction of pipe line outlets to serve particular markets; (2) to design pipe lines necessary to serve those fields adequately; (3) to determine the location of industrial and chemical plants; (4) to finance the development of natural gas properties, and the construction of natural gas pipe lines; (5) to determine fair and adequate depletion allowances and depreciation rates; (6) to justify applications for natural gas pipe lines before various regulatory bodies; (7) to determine the number of wells required to exploit the reserves most economically; (8) to aid in establishing values for the purchase or sale of natural gas properties, and for inheritance tax purposes; (9) to determine equities under unitized operations, and (10) to provide a basis for calculating the economics of gas cycling operations.

History of the estimation of natural gas reserves. The natural gas industry in the United States had its beginning during 1826 when natural gas was used for lighting the city of Fredonia, New York. The first natural gas pipe line was a 25-mile wooden line constructed from hollowed logs; this line connected West Bloomfield and Rochester, New York. There is no record of an attempt to estimate the gas reserve at West Bloomfield; however, an attempt was made to determine the capacity of the well by measuring the time required to fill a large balloon.

One of the earlier publications concerning estimation of natural gas reserves is the *Manual for the Oil and Gas Industry*, published by the Treasury Department, United States Internal Revenue in 1919. The following methods of computing "gas depletion" are listed: (1) Production decline of the gas well or property; (2) decline in open flow capacity; (3) comparison with the life history of similar wells or properties, particularly those exhausted or nearing exhaustion; (4) size of the reservoir and pressure of gas, or pore space method; (5) other indications, such as the decline in minute pressure (minute pressure is the pressure recorded at the wellhead after the well has been closed for one minute), or the appearance of oil or water in the well or neighboring wells, were listed as being significant indications of the length of life of a gas well.

Also in 1919 E. W. Shaw published a discussion of the estimation of gas reserves entitled "Principles of Natural Gas Land Valuation." He lists the following methods: (a) Pore space method based on the size of the reservoir and the pressure of the gas; (b) past production compared with, (1) rock pressure decline (2) capacity decline, and (3) line delivery decline; (c) production curve where production has been maximum and controlling conditions uniform, (d) comparison with performance records of the wells and tracts that are comparable.

In 1922, Ruedemann and Gardescu published an article entitled "Estimation of Reserves of Natural Gas Wells by Relationship of Production to Closed Pressure." They state that three types of well tests were then being used to determine the value of gas wells; namely, open flow capacity, closed pressure, and minute-pressure-above-the-line. Open flow tests were not usually available, and the fact that line pressure varied considerably made the use of the minute-pressure-above-the-line method precarious. The general method then in use, and also the method advocated by the Internal Revenue Bureau, was the Constant Production to Pound Decline Method. Ruedemann and Gardescu criticized this method, and advocated what they called the Area Method. The main theme of their paper was "to show that the area corresponding to a closed pressure decline is proportionate to the amount of gas produced, and that volume is not proportionate to the decline in closed pressure." The area referred to above is the area under the curve of closed pressure plotted against time.

Roswell H. Johnson and L. C. Morgan published an article in 1926 entitled "Critical Examination of Equal Pound Loss Method of Estimating Gas Reserves." They state that the most accurate method of natural gas reserve estimation is to extrapolate a curve of production per pound drop plotted against time.

In 1928, J. Versluys in "An Investigation of the Problem of the Estimation of Gas Reserves" suggested a method of volumetric estimation when the thickness and porosity of the producing formation are not known. The method consists of observing pressures in closed-in wells, while flowing a central well at various rates. By use of calculus and curves of plotted test data a value for the porosity times thickness factor can be obtained; however, the areal extent of the reservoir has to be estimated by other methods before the reserve can be calculated.

In 1935 Dr. E. A. Stephenson published an article on "Valuation of Natural Gas Properties." He lists the most common methods of estimating gas reserves as: (1) The porosity-pressure method; (2) the rock pressure-production decline method, and (3) miscellaneous methods, such as comparison with other gas fields and open flow capacity indications. He also points out the necessity of using isobaric maps in obtaining the average field pressure rather than using an arithmetical average of individual well pressures. Stephenson says that, "Failure of Johnson and Morgan to recognize this fact led to entirely erroneous conclusions as to the merits of the equal pound loss in pressure method of estimating reserves."

The many criticisms of the equal-pound-loss method by early writers indicate failure of the method in many instances. These failures seem to be attributable to two causes: (1) Presence of a water drive, in which case the method is inapplicable, or (2) use of arithmetic average wellhead pressures in incompletely developed reservoirs.

Present methods of estimating natural gas reserves. Natural gas reserve estimators currently use the same general methods described by the early authors with the addition of certain refinements made possible by the greater amount of data that is obtained on gas reserves, and the increased knowledge of reservoir mechanics.

The terms currently used by the American Gas Association to describe the various types of gas in accordance with the nature of its existence in the reservoir are defined as follows:

(1) Non-associated gas—free gas not

*Presented before the Tulsa, Oklahoma, and Los Angeles, California meetings of the Petroleum Division, American Institute of Mining and Metallurgical Engineers, October 8-9-10 and 23-24, 1947, respectively.

in contact with crude oil in the reservoir.

(2) Associated gas—free gas in contact with crude oil in the reservoir.

(3) Dissolved gas—gas in solution in crude oil in the reservoir.

● **Methods of estimating non-associated gas reserves.** *Volumetric method.* This method, as currently used, makes use of structural and isopachous maps based on data from electrical logs, cores, and drillstem and production tests. Sand volumes are obtained by planimetering. Core analysis data and electrical log interpretation permit reasonable estimates of porosity, connate water, and net productive thickness so that the volume of gas filled pore space may be calculated. Laboratory analysis of the gas for determination of its compressibility at various pressures and temperatures, and the determination of reservoir pressure and temperature by recording instruments make it possible to calculate the volume of gas contained in the reservoir with reasonable accuracy.

Calculation of the gas in place in the reservoir may be accomplished by use of the following formula:

$$Q = 43{,}560 \times \phi \times (1 - Sw) \times \frac{P}{P_b} \times \frac{460 + t_b}{460 + t} \times \frac{1}{Z}$$

Where:

Q = cu ft of gas per acre-ft at base temperature and pressure,

43,560 = number of cu ft per acre-ft,

ϕ = porosity expressed as a decimal fraction,

Sw = interstitial water expressed as a decimal fraction,

P = reservoir pressure, psia,

P_b = base pressure, psia,

t = reservoir temperature, F,

t_b = base temperature, F,

Z = compressibility factor at pressure P.

Reserves may also be calculated volumetrically by use of the pound mol as a base for computation. The following formula is used:

$$V = \frac{ZNRT}{P}$$

Where:

V = volume in cu ft,

Z = compressibility factor at pressure P,

N = number of pound mols,

R = 10.71,

T = absolute temperature,

P = pressure, psia.

The volume occupied by one pound mol of any gas at standard conditions is 379.4 cu ft. Therefore, the volumetric formula may be expressed as follows:

$$Q = 43{,}560 \times \phi \times (1 - Sw) \times \frac{379.4}{V}$$

Where:

V = cu ft of gas per pound mol at reservoir conditions.

In the event a water drive is not anticipated the volume of gas that will remain in the reservoir at the expected abandonment pressure may be calculated, and deducted from the volume of gas initially in place to determine the volume of recoverable gas. The abandonment pressure to be used depends on the price of gas, the productivity indices of the wells, the size of the field, its location with respect to market, and the type of market. If the market is a transmission pipe line, the operating pressure of the line may be a controlling factor in the abandonment pressure for small fields; however, in the case of large fields, installation of compressor plants may be economically feasible, thus lowering the abandonment pressure substantially below the operating pressure of pipe lines serving the area.

In the case of water-drive fields, the pressure will be wholly or partially maintained by the movement of water into the reservoir as gas is withdrawn, the magnitude of pressure decline being dependent on the rate of gas withdrawal with respect to the rate of water advancement.

Water advancement rate is a function of the area of the gas-water contact, the permeability of the reservoir, and the pressure differential created by gas withdrawals. Recoverable gas is usually estimated for water drive reservoirs by applying a recovery factor to the calculated volume in place. The selection of a recovery factor depends on the thickness and homogeneity of the sand, the relative permeability of the sand to gas and water at varying gas saturations, the per cent of the gas-containing portion of the reservoir originally underlaid by water, the dip of the reservoir beds, and the amount of structural closure above the gas-water contact. The recovery factor will be highest when the sand is uniform and homogeneous, the permeability of the sand to gas is high at low gas saturation, the per cent of the gas-containing portion of the reservoir originally underlaid by water is relatively small, the beds are relatively steep, and the amount of structural closure above the gas water contact is large.

Recovery factors used by different estimators under the same conditions vary widely. Study of the recovery from depleted fields for which volumetric data are available is helpful in selecting a recovery factor.

The volume of gas in place per acre-foot may be computed at any stage of depletion at which the reservoir pressure is known. If the volume of gas that has been withdrawn from the reservoir is also known, the following formula may be used to determine the volume of the reservoir if a water drive is not operative.

$$A = \frac{C}{Q_o - Q}$$

Where:

A = acre ft of gas pay,

C = cumulative gas production in cu ft to reservoir pressure P,

Q_o = cu ft of gas initially in place per acre-ft,

Q = cu ft of gas in place per acre-ft at the reservoir pressure P.

If this calculation is made at various reservoir pressures and the reservoir volume is indicated to be the same by each calculation, the absence of water drive is indicated.

In the event that water is encroaching into the reservoir this calculation will result in an apparent increase in the number of acre-feet in the reservoir at each successive time. When this condition is encountered it is necessary to rely solely on geologic data to determine the reservoir volume. Successively larger reservoir volumes might also be calculated in the case of gas fields where water drive is absent if only a small portion of the reservoir is developed and shut-in pressures measured in the wells are considerably below the true pressure of the reservoir. Then as additional wells are drilled the calculated average pressure approaches the true pressure of the reservoir.

Discussion of the factors in the volumetric formula. The porosity of cores can be measured with a high degree of accuracy; however, even if all wells are cored only a minute fraction of the reservoir volume is sampled. For this reason the estimation of porosity is especially hazardous for limestone formations and for some erratic sandstones in which cementation or argillaceous material cause rapid porosity variations. However, many producing sands have sufficient homogeniety that the porosity can be estimated with a fair degree of accuracy.

Gas reserve estimates must often be made for reservoirs for which no cores have been analyzed. In such cases porosity can be estimated from a general knowledge of the formation based on data from other fields.

Porosity is the most important factor in the volumetric formula and a small error in porosity will result in a large error in the estimated reserve. For instance, if the porosity is actually 20 per cent and is estimated to be 15 per cent the result is a reserve estimate that is 25 per cent low. (Curve 2 shows the relationship of the original volume of gas in place to the depth of the reservoir for various net porosities).

The connate water factor is one that must often be estimated, for laboratory determinations are not always available. Advent of restored state, or capillary pressure, methods are resulting in more and better information on connate water than has been available in the past. The connate water factor became generally used in the volumetric formula in about 1936 following studies by Horner, Lewis, Schilthuis, Pyle, Jones, and others.

In many instances use of the electrical log to estimate connate water will give satisfactory results by Archie's method, Guyod's method, or the resistivity departure curve method.

Pressure and temperatures are usually obtained by measurement. In the event measurements are not available fairly accurate estimates can be made from the known rate of pressure and temperature increase with depth in the area.

The compressibility factor can be accurately determined by laboratory measurement. If laboratory measure-

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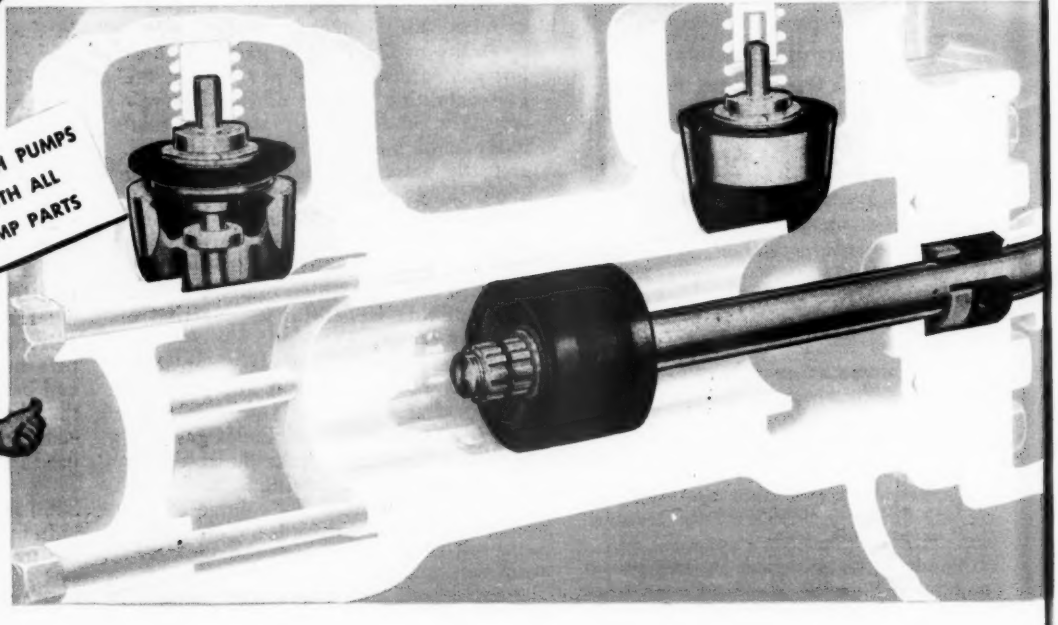

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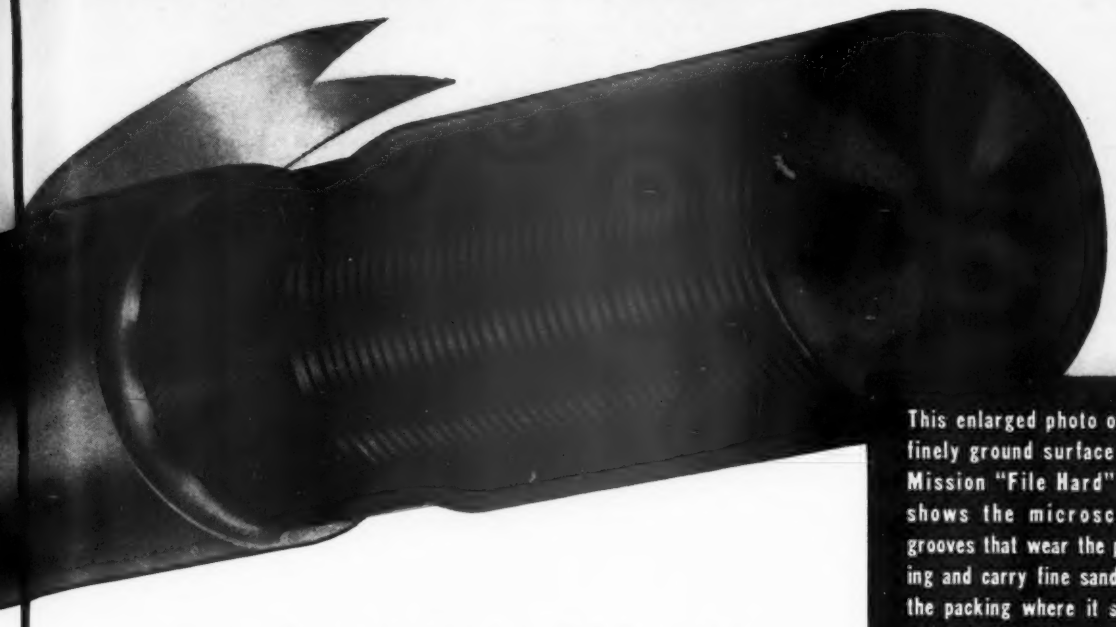

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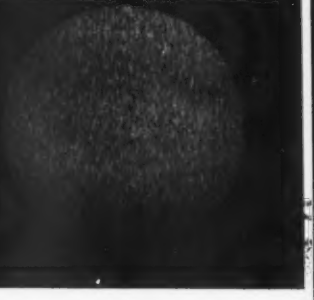
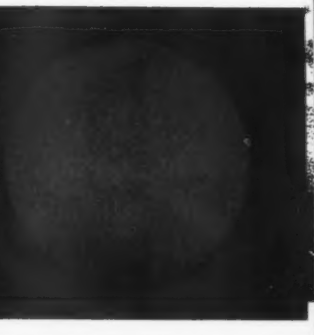
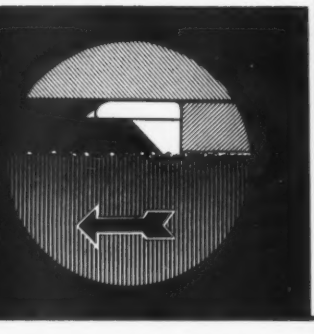


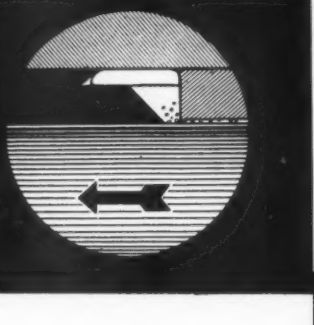
This enlarged photo of the finely ground surface of a Mission "File Hard" Rod shows the microscopic grooves that wear the packing and carry fine sand into the packing where it sticks and cuts the rod.



This enlarged photo shows the "Satin Finish" surface now supplied on Mission "File Hard" Rods. Notice the absence of sharp irregularities to wear the packing and catch sand.



This schematic drawing shows how sand is pulled into the packing by the ridged surface of a ground rod. These sand particles become imbedded in the packing and cut the rod.



Since the smooth surface of the Mission Satin Finish Rod does not carry sand into the packing, the rod wear from sand imbedded in the packing is considerably reduced.

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ments are not available reasonable estimates can be made by the use of published data. This factor is sometimes ignored by estimators; however, an error of as much as 30 per cent may result from its omission. This factor is especially large for gases rich in condensate and occurring at depths of 3500 to 4500 ft, in which case its omission results in underestimation of the reserve. (See Curve 1). Omission of this factor results in overestimation of the reserve in abnormally high pressure reservoirs frequently encountered below 10,000 ft in some areas of the Gulf Coast.

In calculating the compressibility factor at abandonment pressure, the estimator should consider changes in the composition of the gas that will occur as a result of cycling or retrograde condensation.

The authors' experience in checking estimates made by themselves and others indicates that the greatest errors in volumetric calculations are usually the result of incorrect determinations of net productive thickness.

Usually the thickness is underestimated in sands interbedded with shale unless all wells have been cored with a high per cent recovery and careful core description, as productive layers less than a foot thick which are not indicated by the electric log may comprise a large portion of the reservoir.

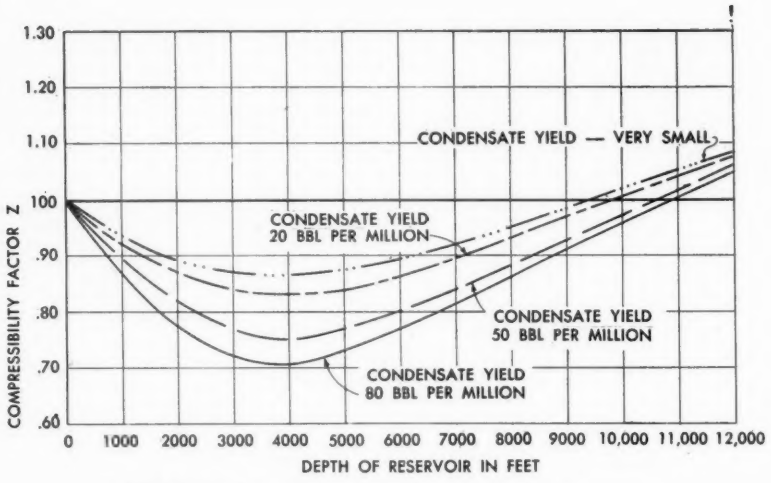
On the other hand net productive thickness can easily be overestimated in the case of indurated sandstones such as the Travis Peak formation (Hosston) of Lower Cretaceous age in East Texas and North Louisiana and the Wilcox formation of Eocene age in South Texas. The authors are familiar with several instances in which the estimates by various engineers differed by several hundred per cent as a result of differences in estimating the net productive thickness of formations of this type. Net productive thickness also can be overestimated in limestone or dolomite reservoirs due to the occurrence of dense streaks in the reservoir rock.

Aids in estimating properly the net productive thickness are cores, drilling-time logs, radioactivity logs, and measurement of gas increases while drilling with cable tools. In many cases sufficient data are not obtained to make a reliable volumetric estimate of reserves in limestone and indurated sandstone reservoirs.

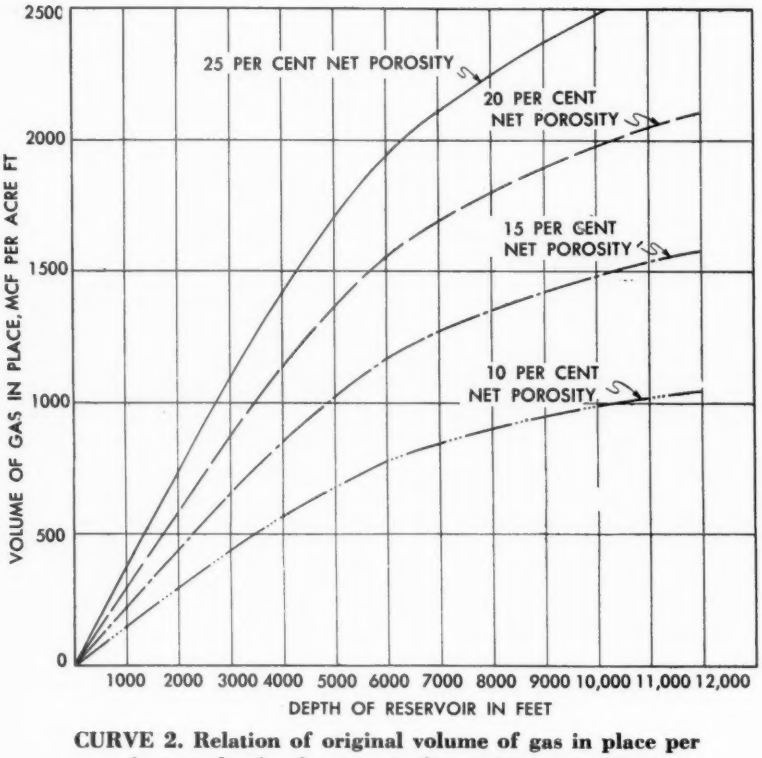
Estimates of reserves in new or incompletely developed fields may vary widely because of errors in estimating the areal extent of production. To minimize these errors, subsurface data should be supplemented with geophysical data whenever possible.

The pressure bases ordinarily used vary from 14.4 to 16.7 psi. The estimator should be careful to indicate clearly the pressure base at which the reserves are stated. Reserves stated at a base of 14.4 psi will be approximately 16 per cent greater than the same reserves stated at a base of 16.7 psi. The base temperature is ordinarily 60 F.

The accuracy of the factors used in the volumetric formula by an estimator



CURVE 1. Curves showing change in the compressibility factor with depth and composition of the wet gas.


2500
2000
1500
1000
500
0
VOLUME OF GAS IN PLACE, MCF PER ACRE FT
25 PER CENT NET POROSITY
20 PER CENT NET POROSITY
15 PER CENT NET POROSITY
10 PER CENT NET POROSITY
1000 2000 3000 4000 5000 6000 7000 8000 9000 10,000 11,000 12,000
DEPTH OF RESERVOIR IN FEET

CURVE 2. Relation of original volume of gas in place per acre foot to depth of reservoir for various net porosities.

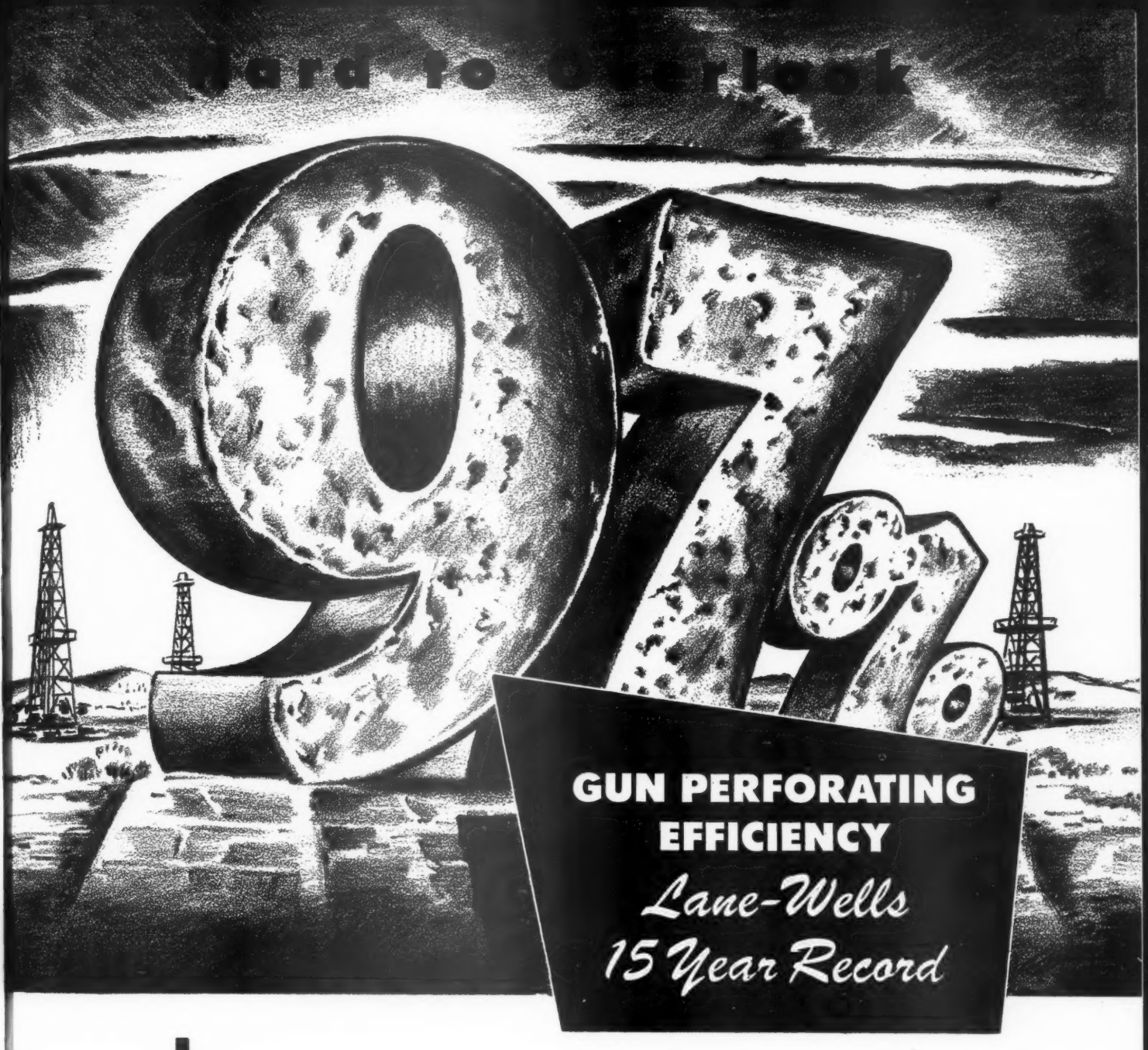
BASE PRESSURE—14.65 PSI. WET GAS GRAVITY—.678.
SEPARATOR YIELD—20 BBL PER 1,000,000 CU FT GAS

for any particular reserve calculation depends on the amount of data available, and the experience and judgment of the estimator.

The importance of experience and judgment may be illustrated by an estimate made by H. W. Bell and R. A. Cattell, U. S. Bureau of Mines in July, 1921. They estimated the gas reserve of the Monroe gas field in northeast Louisiana by the volumetric method. This field produces from a chalk formation of Upper Cretaceous age at a depth of 2,000 to 2,300 ft. Although the limits of the field had not been defined, the thickness of the gas rock was extremely variable and data regarding rock pressure were few, their estimate of the gas in place differs by only 15 per cent from current estimates made with the benefit of 26 years additional performance data.

The decline curve method. The pressure decline curve is one of the most widely used, and one of the most reliable of the several means of estimating gas reserves in those reservoirs that do not have a water drive. Several types of pressure decline curves are used. One or more of these curves should be constructed for each reservoir studied to determine whether a water drive is present and its relative importance.

Early pressure decline curves were constructed from closed-in wellhead pressures, sometimes referred to as "rock pressures." Since the development of methods of measuring and calculating reservoir pressures, most engineers and



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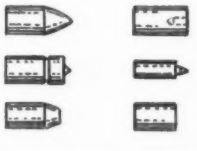

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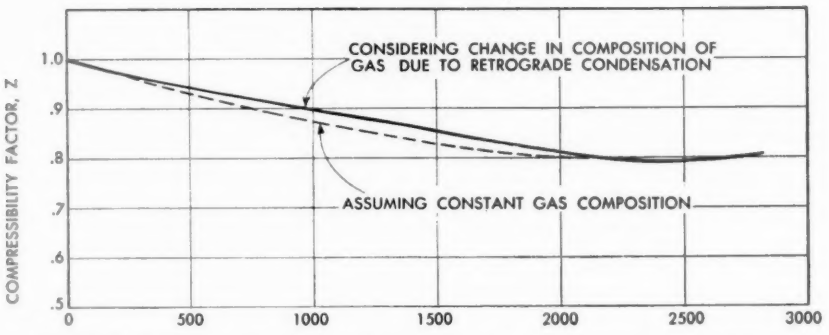


CURVE 3. Variation of compressibility factor "Z" with production at reservoir temperature of 188 F for a wet gas having an initial gravity of .812.

geologists use reservoir pressures in plotting decline curves.

In the event a water drive is not present wellhead or reservoir pressure plotted against cumulative production may be extrapolated in a straight line to the expected abandonment pressure, and the ultimate recovery read direct. Estimates made in this manner ignore the effect of deviation from Boyle's law.

When the accuracy of other data justify refinements, reservoir pressure divided by the compressibility factor (Z) may be plotted against cumulative production to correct for the effect of deviation from Boyle's law. (See Curves 3 and 4).

The equal-pound-loss method is a special use of this method in which a curve is not actually constructed, but the production at the point of intersection of the curve with the abandonment pressure is calculated by assuming a constant slope determined by the initial pressure and the pressure after a known volume of gas has been withdrawn. This method is not as reliable as a decline curve since only two pressure points are used.

The equal-pound-loss method may be corrected for deviation of gas from Boyle's law by use of the following formula, published by Dr. E. A. Stephenson in the "Geology of Natural Gas" in 1935:

$$\text{"}R = Q\,\frac{(Pr\,dr - Pa\,da)}{(Pi\,di - Pr\,dr)}$$

Where:

R = gas reserve to abandonment pressure,

Q = production of the reservoir during the decline in pressure from P_i to P_r,

Pi = initial pressure of the reservoir,

Pr = reservoir pressure as of the date of appraisal,

Pa = reservoir pressure as of the date of abandonment,

di = deviation factor at Pi,

dr = deviation factor at Pr, and,

da = deviation factor at Pa".

Cumulative pressure drop may be plotted against cumulative production on logarithmic paper. This method of plotting was developed by H. C. Miller of the U. S. Bureau of Mines. If cumulative production per pound drop is constant the curve will be a straight line with a slope of 1 (45-deg angle with the horizontal). If water, oil, or gas is encroaching into the known gas area the slope will be less than 1 (an angle of less than 45 deg with the horizontal). The effect of deviation from Boyle's law will cause a slight flattening of the curve as illustrated in Curve 6. If this curve has a slope of 1, or slightly less, the ultimate production may be determined by extrapolating the curve to a pressure drop equivalent to the initial pressure minus the expected abandonment pressure.

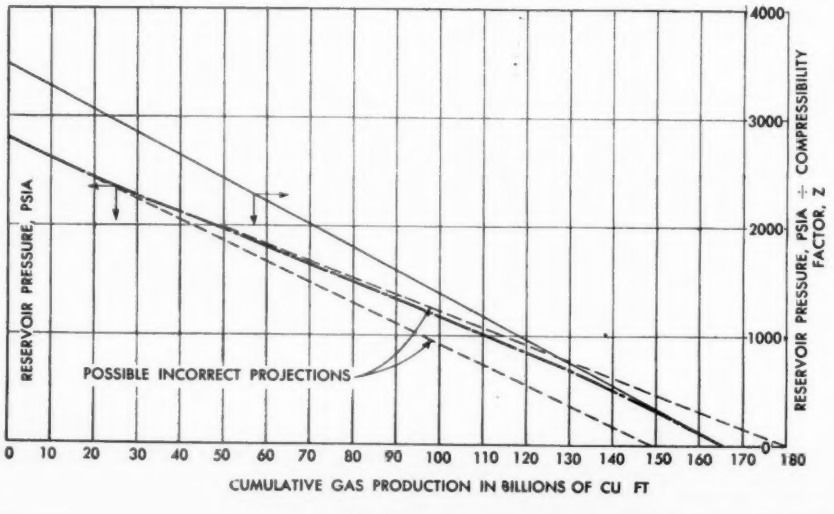
Cumulative production per pound decline in closed-in wellhead or reservoir pressure may be plotted against cumulative production or against time. If values for cumulative production per pound pressure decline are constant, the resulting curve is a straight line parallel to the time or cumulative production axis, and it may be assumed that estimates of reserves made by use of the equal-pound-loss method or by extrapolation of the pressure cumulative production decline curve will be correct. If the slope of the curve is negative (i.e. values of cumulative production per pound drop increase with cumulative production or time) water, oil, or gas is encroaching into the known gas area. It should be remembered that the effect of deviation from Boyle's law will cause a slight increase in values even if a water drive is not present. This effect is shown on Curve 7.

A large error is often introduced by the method of obtaining the average field pressure. If numerical averages of the producing wells are used for each point plotted, the rate of drilling influences the slope of the curve. If only a few wells are drilled in a large reservoir of low permeability the numerical average of their pressures after considerable gas has been withdrawn may be considerably lower than the average pressure of the reservoir. If the drilling rate is rapid enough with respect to permeability of the reservoir and rate of gas withdrawal, new wells may be completed with closed-in pressures considerably higher than the closed-in pressures of wells already producing. The effect of this is a flattening or a reversal of slope of the cumulative production pressure decline curve.

Errors of this type can be reduced by constructing isobaric maps and planimetering to obtain the weighted average pressure. The reservoir area used in obtaining the weighted average pressure should be the same for each point plotted. If a reservoir is determined to be larger than previously estimated, all isobaric maps should be corrected and pressures recalculated so that all points on the curve represent the average pressure of the same area. Greater accuracy can be obtained by weighting pressures on the basis of reservoir pore volume rather than on the basis of surface acreage, if there are large variations in net productive thickness.

● **Methods of estimating associated gas reserves.** Certain additional problems are encountered in estimating associated gas reserves. First, the volume of gas that may be produced from the gas

CURVE 4. Comparison of theoretical reservoir pressure—cumulative production curve with theoretical reservoir pressure divided by Z—cumulative production curve.



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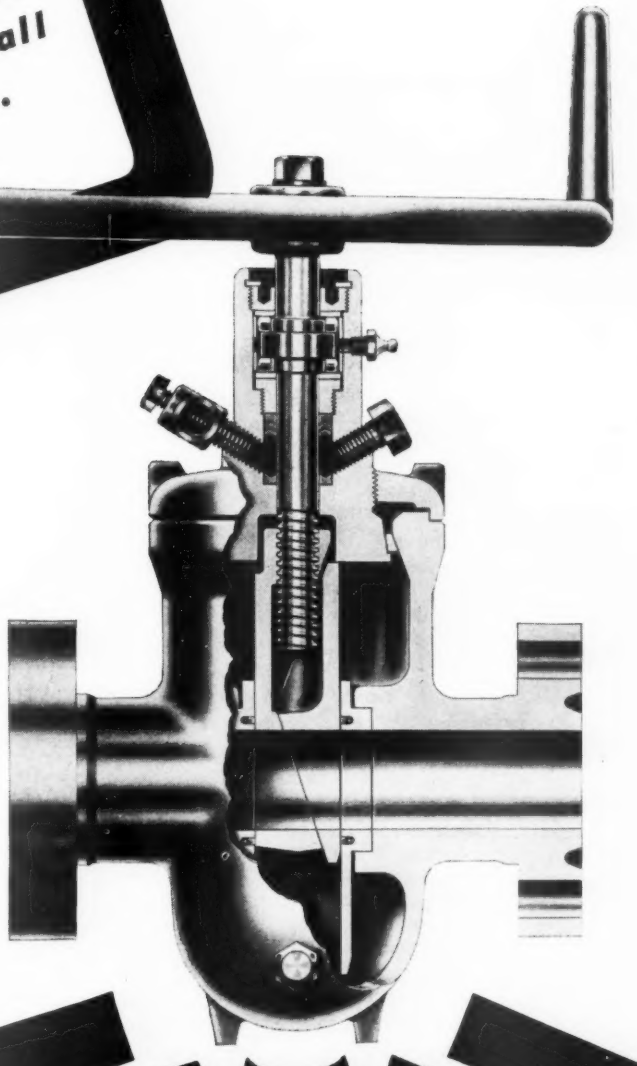

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cap may exceed the original volume of gas contained in the gas cap because of migration of solution gas up structure with reduction of pressure on the oil zone. Second, the reservoir volume occupied by the gas cap may increase as oil is withdrawn or it may decrease due to movement of oil up structure. Third, the volume of gas produced from the gas cap may not be known accurately because some oil wells near the gas-oil contact may produce associated gas as well as dissolved gas.

Decline curve methods for estimating the amount of gas remaining in a gas cap are inaccurate, for the volume of the reservoir will remain constant only under exceptional conditions and dissolved gas may migrate into the gas cap.

The problem of estimation is simplified if no effort is made to distinguish between associated and dissolved gas. The total original gas reserve may be computed and the cumulative production of associated and dissolved gas subtracted to obtain the total gas reserve remaining at any time.

● **Methods of estimating dissolved gas reserves.** The principal method of estimating dissolved gas reserves is a volumetric method. The original gas in place is determined by estimating the original volume of stock-tank oil in place, and multiplying this value by the original solution gas-oil ratio. The recovery factor to be applied depends on the mechanics under which the reservoir will be produced.

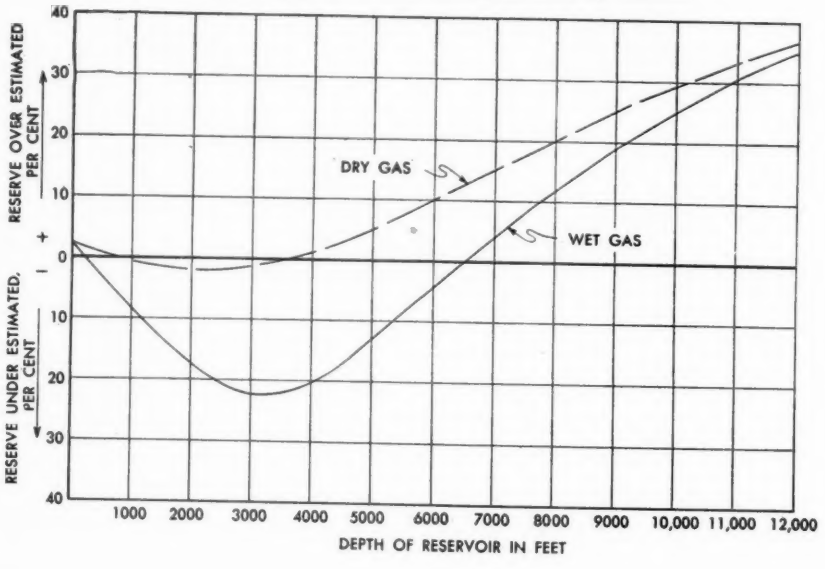
(1). *Water drive.* In the case of reservoirs in which the pressure does not drop below the bubble point, the gas-oil ratio will be constant and the recovery factor for gas will be the same as the recovery factor for oil. The East Texas field is an example of this type of reservoir.

In the case of reservoirs in which the pressure drops below the bubble point, the recovery factor for gas will be greater than the recovery factor for oil. In order to make an accurate determination of the recovery factor, it is necessary to predetermine the pressure history of the field by material-balance and water-influx calculations, or by extrapolating a curve of pressure against cumulative production, if rates of production have been constant. Having estimated the pressure history of the field the amount of gas to be recovered can be reasonably approximated by mutiplying the volume of recoverable oil by the original dissolved gas-oil ratio and adding an amount equal to the volume of unrecoverable oil times the difference in the original dissolved gas-oil ratio and the amount of gas in solution per barrel of oil at the average pressures at which the reservoir is expected to be produced.

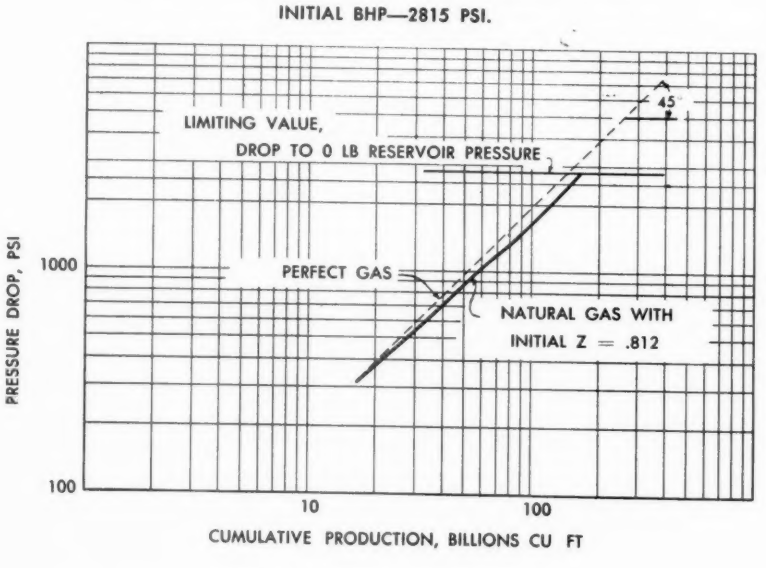
(2). *Constant-volume type reservoir.* To calculate the amount of recoverable gas it is necessary to calculate the gas originally in place and subtract the gas that is calculated to be unrecoverable at the expected abandonment pressure of the reservoir. This may be calculated by the following equations:

$$R = O_p G_o - U$$

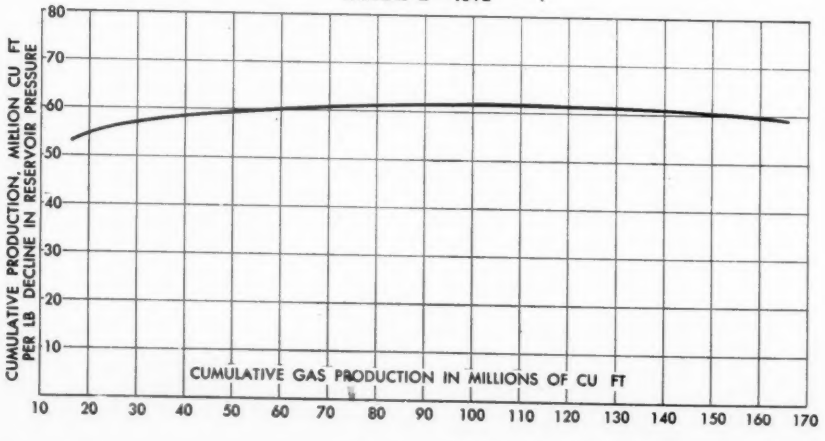
CURVE 5. Per cent error resulting from omission of both temperature and compressibility factor.



CURVE 6. Theoretical curve pressure drop—cumulative production for constant volume reservoir.



CURVE. 7. Relation of cumulative production per pound decline in reservoir pressure to cumulative production for reservoir with 166.34 billion cubic feet of gas in place.


INITIAL Z = .812
CUMULATIVE PRODUCTION, MILLION CU FT PER LB DECLINE IN RESERVOIR PRESSURE
80
70
60
50
40
30
20
10
CUMULATIVE GAS PRODUCTION IN MILLIONS OF CU FT
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170

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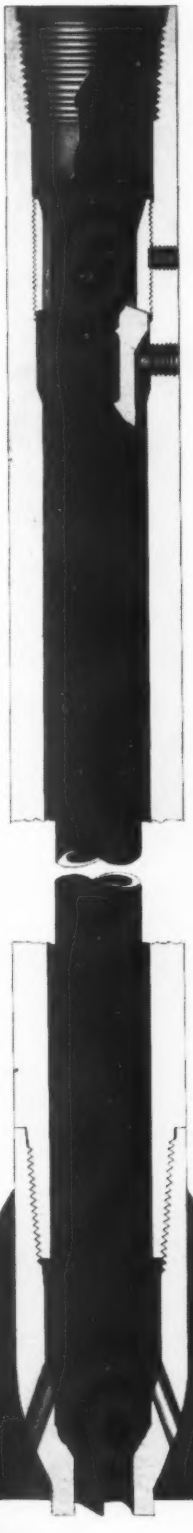

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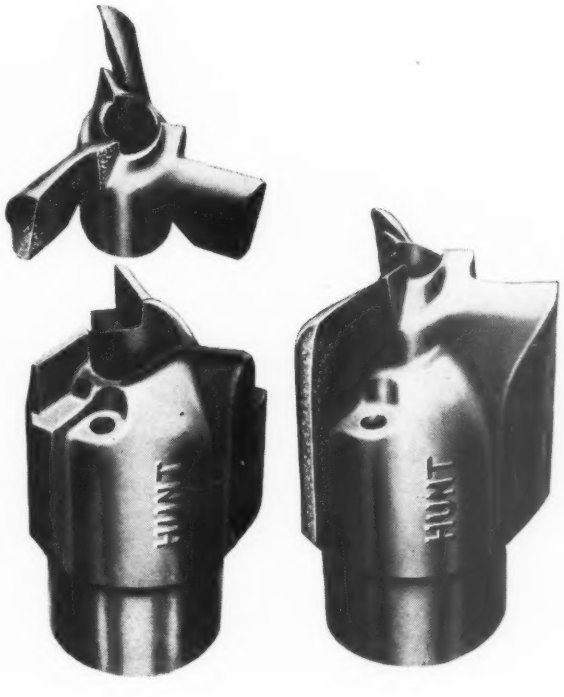

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or $(V - O_u\ Fv_a)\ 5.61 \dfrac{(P_a)}{(P_b)} \dfrac{(520)}{(t+460)} \dfrac{(1)}{(Z_a)} + O_u\ G_a$

V = void space in reservoir, bbl, or, $7758 \times \phi \times (1\text{-}S_w)$,

O_u = unrecoverable oil in barrels at stock-tank conditions, or $(O_p - O_r)$,

O_p = original oil in place in bbl at stock-tank conditions, or $\dfrac{V}{Fv_o}$

O_r = recoverable oil in barrels at stock-tank conditions,

Fv_o = original formation volume factor,

P_a = reservoir pressure at abandonment, psia,

P_b = base pressure, in psia,

t = reservoir temperature, F,

Z_a = compressibility factor at P_a,

G_a = cu ft of gas measured at base pressure in solution per bbl of stock-tank oil at P_a, and

G_o = cu ft of gas measured at base pressure originally in solution per bbl of oil at stock-tank conditions.

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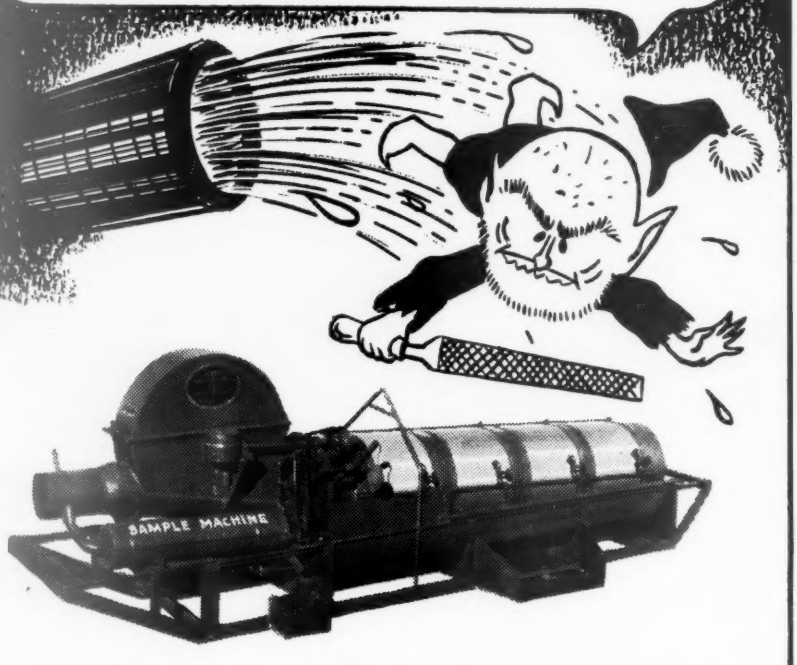

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● **Common errors in method of estimating natural gas reserves.** The following errors have been noted in reviewing natural gas reserve estimations:

1. Construction of a pressure curve for an early well in a field and application of the indicated reserve to later wells on a per-well or per-acre basis.

2. Construction of pressure-decline curves from arithmetic average pressures when well spacing is not uniform and the number of wells is not constant.

3. Construction of pressure-decline curves using pressures obtained from isobaric maps, all of which do not cover the same area.

4. Failure to check decline-curve-estimates by volumetric calculations to determine whether the area, thickness, and porosity required to contain the estimated reserve conflict with the available data.

5. Failure to consider the effect of deviation from Boyle's law.

6. Assuming that neglect of corrections for temperature and compressibility are compensating. (See Curve 5.)

● **References**

1. E. W. Shaw: The Principles of Natural Gas Land Evaluation. *AAPG* 378 (1919).
2. J. Versluys: An Investigation of the Problem of Estimation of Gas Reserves. *AAPG* 1095 (1928).
3. R. W. Brown: The Valuation of Oil and Gas Lands (1924) *McGraw Hill Book Company.*
4. R. H. Johnson and L. C. Morgan: A Critical Examination of the Equal Pound Loss Method of Estimating Gas Reserves. *AAPG* 901, September, 1926.
5. C. P. Parsons: Accurate Estimates of Gas Reserves. *O&GJ*, May 10, 1928.
6. P. Ruedemann and I. Gardescu: Estimation of Reserves of Natural Gas Wells by Relationship of Production to Closed Pressure. *AAPG* 444, September-October, 1922.
7. J. I. Dodge, H. C. Pyle, and E. G. Trostel: Estimation By Volumetric Methods of Recoverable Oil and Gas from Sands, *AAPG* 1302 (1941).
8. E. A. Stephenson: Valuation of Natural Gas Properties. Geology of Natural Gas, *AAPG*, 1011. A Symposium (1935).
9. E. W. Shaw: Natural Gas Reserves of Parts of North Texas. *U. S. Geological Survey, Bulletin 626* (1916).
10. P. M. Biddison: Estimation of Natural Gas Reserves. Geology of Natural Gas, *AAPG*. 1035. A Symposium (1935).
11. H. P. Westcott: *Handbook of Natural Gas* (1920).
12. Manual for Oil and Gas Industry Under Revenue Act of 1918. Treasury Department of U. S. (August, 1921).
13. G. A. Burrell and J. W. Robertson: Compressibility of Natural Gas and Its Constituents. *U. S. Bureau of Mines Tech. Paper 158* (1917).
14. G. A. Brown: Deviations of Natural Gas From Ideal Gas Laws. Clark Bros., Inc.
15. M. B. Standing, E. N. Lindblad, and P. L. Parsons: Calculated Recoveries by Cycling from a Retrograde Reservoir of Variable Permeability. *Petroleum Technology*, May, 1947.
16. H. W. Bell and R. A. Cattell: The Monroe Gas Field, Louisiana Department of Conversation *Bulletin No. 9*, July, 1921.
17. H. C. Miller: Oil Reservoir Behavior Based Upon Pressure Production Data. U. S. Bureau of Mines, R.I. 3634, April, 1942.
18. American Gas Association and American Petroleum Institute Joint Publication. Proved Reserves of Crude Oil, Natural Gas Liquids, and Natural Gas. December 31, 1946.
19. O. F. Thornton and D. L. Marshall: Estimating Interstitial Water by the Capillary Pressure Method. *Petroleum Technology*. January, 1947.
20. G. E. Archie: The Electrical Resistivity Log as an Aid in Determining Some Reservoir Characteristics. *A.I.M.E. Transactions* 146 (1942), p. 54.
21. R. J. Schilthuis: Connate Water in Oil and Gas Sands. *A.I.M.E. Transactions*, 127 (1938), p. 199.
22. H. Guyod. Electric Log Interpretation *The Oil Weekly*, December 24, 1945.
23. Resistivity Departure Curves, Schlumberger Well Surveying Corporation (May 1947).

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Advancement in Contract Drilling*

By A. J. HEISER, *Petroleum Engineer*, Brown Drilling Company

● **Abstract.** This paper treats of the progressive trend of contract drilling. The contract driller is today drilling the majority of wells in the United States. His operations are more efficiently and intelligently performed than ever before.

The factors cited as being responsible for his advancements are classified under equipment, technique, and efficiency of personnel. They emphasize the contractor as a specialist drilling wells for a profit.

Contracting costs have increased while revenues per foot have declined. It is brought out that the economic situation of the contracting industry demands sound bidding on the part of the contractor, and closer cooperation on the part of the oil operator. Continued improvement, in both a business and a mechanical sense, will assure for the future the complete and reliable service the contractor now offers.

● **Introduction.** The contractor is playing an important role in the petroleum industry today. His thinking and his way of doing things should be matters of interest to those engaged in other phases of the oil business. The purpose of this paper is to describe advancements the contractor has made, and to present some of the problems he faces in his operations.

Eighty-two per cent of the wells drilled in the United States in 1947 were drilled by contractors utilizing equipment worth more than $500,000,000.[1] The contractor is an essential part of the petroleum industry, offering it a complete and reliable service that is developing in pace with the expanding oil business.

The history of contract drilling dates back 85 years, nearly to the Drake well itself. It is a history not only of adventure and individualism, but also of terrific highs and lows familiar to hazardous industries. From the beginning, the contracting business was keenly competitive and many a contractor failed because he bid unsoundly when confronted by shortages of work. Out of each low, however, the industry has emerged wiser with improved ability in both a business and a mechanical sense. Today, contract drilling is more efficiently and intelligently performed than ever before.

The high percentage of wells being drilled by the contractor proves that the contractor continues to be of economical benefit to the operator. That the contractor can drill wells for the operator and show him a material gain is, in fact, his justification for existence.

It is significant to note that recently several operators have disposed of their drilling rigs and now contract all their work. Such a trend would not take place if it did not benefit the operator.

The contract drilling industry is aware of the responsibility it has assumed, and will continue to improve and broaden, to carry its share of the load in the drive to find new and sorely needed oil reserves.

A variety of factors are responsible for the progressive trend of contract drilling. They are factors that emphasize the contractor as a specialist concerned with drilling wells efficiently for a profit. These factors fall under the general classifications of equipment, technique, and efficiency of personnel.

● **Equipment.** Contractor owned equipment is more advanced and better maintained than ever before. It is rigged for fast moves and unitized for simplicity. The contracting industry offers a selection of machinery to the operator to cover any job that may arise. Several of the deepest wells in the world have been drilled by contractors.

As a major buyer and user of drilling equipment, the contracting industry has a definite responsibility to the manufacturer. To design and build equipment that will give the user greater efficiency in his operations, the designer must have ideas and data from the field. The contractor is in an ideal position to help the manufacturer with this, and the two cooperating can unite the theoretical and the practical to produce equipment that will result in more footage for less cost. The nature of contracting demands that the equipment purchased justify its enormous capital outlay by rendering efficient and trouble-free service. All contracting calculations are based on the assumption that the equipment will perform according to specification.

The American Association of Oilwell Drilling Contractors sponsors many research projects to aid the individual contractor. The economic set-up of the contractor does not permit him to employ a large staff of engineers, but he approaches the same ends by cooperating with his competitors to raise the standards of his industry collectively. At the present time, the Association is sponsoring an investigation of methods to improve the performance and the life of the drill string. This research was instituted in September, 1945, and is continuing today with a study on the nondestructive testing of drill pipe. The value of this research should not be underestimated because the drill string is the one part of a contractor's equipment that he cannot examine or repair when it is in operation.

One of the difficult jobs in contracting is to predict what type and size of equipment should be purchased for future work. Will there be more 5000 to 7000-ft jobs than 8000 to 10,000-ft jobs? The problem is not easily if ever solved, but the logical source for an answer is the oil operator himself. He will plan the drilling programs that the contractor will bid on. It is recognized that these are days of "where to drill next", but, wherever possible the oil company should cooperate with the contractor to aid him in selecting proper equipment for future drilling.

● **Technique and efficiency of personnel.** The need for trained personnel both on the rigs and in the office has never been greater than it is now. The very life of the contractor is dependent upon the ability of his men to increase their efficiency month by month and year by year. That the technique of drilling oil wells and the efficiency of the men performing their work has improved is demonstrated by the fact that the speed of drilling increased 15 per cent in the period from 1941 to 1947.[2] Better technique and more efficient personnel made such an improvement possible.

The present supervision employed by drilling contractors is far superior to anything we have known in the past. It is a different type of supervision. It is one of varied and complete quantity and of high quality. The majority of modern day contractors provide 24-hr rig supervision. They hire toolpushers who will be concerned with such things as bit performance, wire line service, rig maintenance, and safety. They know the importance of drilling fluid control and utilize mud engineers on their staffs. They employ trained mechanics to eliminate down time. The contractor is knowledge conscious just as are other phases of the oil business. He realizes that the more he knows about his own business the better that his overall operations will be. This ambition for constant improvement in his operations has prompted such ideas as drilling mud schools and vocational training classes. The mud schools are sponsored by the American Association of Oilwell Drilling Contractors, usually in conjunction with local educational institutions. They are given to anyone in the oil industry interested enough to attend and that includes roughneck and engineer alike. The classes have been conducted throughout the oil fields of the country and have had remarkable success. California has only recently started this training, but the enthusiasm from all quarters indicates the need for the course and the desire of the men to improve themselves.

The American Association of Oilwell Drilling Contractors has also sponsored a novel idea at Kilgore College in Texas. A training course has been instituted for young men desirous of working on drilling rigs. A complete drilling rig was donated to further this program. At

*Presented at the Spring Meeting of the Pacific Coast District, Division of Production, American Petroleum Institute, Los Angeles, California, May 6-7, 1948.

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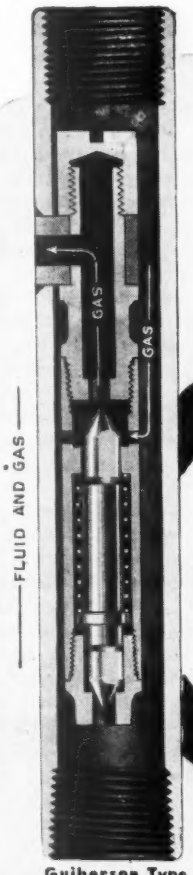

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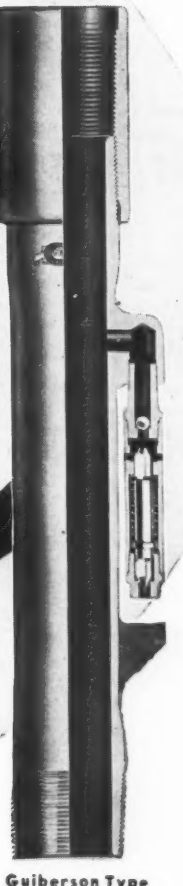

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the completion of the course a man will have had some experience in all the mechanical operations of a rig. He also will have received practical instruction in mud control, engine maintenance, and safety. The first class in the course has been graduated, and the men were placed 100 per cent on rigs all over the country.

Another factor that helped to effect improved operations on contract rigs was the installation and development of a sound safety program. This program was instituted by the American Association of Oilwell Drilling Contractors in 1945. The program consists basically of safety meetings at the rig, using different crew members as chairman each time. Reports are made of each meeting, and the best safety suggestions received are redistributed for the benefit of all. The program has functioned well and has resulted in reduced absenteeism because of injuries, reduced repair bills, improved morale, better employe and employer relationships, and, of course, more efficient use of the company's equipment. It has also reduced considerably the contractor's compensation insurance and public liability rates, which is proof in itself that the plan is successful.

It should be emphasized that the advancement in the phases of contracting activity just discussed has been responsible for the contractor's increased speed of drilling. This speed of drilling is enabling him to stay in business. A survey made in October, 1947, shows that the contractor's labor costs had gone up 35 per cent since 1941. His equipment costs had increased 30 per cent and his rig operating costs 40 per cent. During this same period, the price per barrel of crude oil had increased 69 per cent, yet for the United States as a whole the price per foot that the operator paid for the drilling of a well in 1947 was 1 per cent less than the price he paid in 1941. For California his cost per foot was 2 per cent less.[3]

● **The bid.** One may attribute this paradox to keen competition, but, whatever the reason, the contract drilling industry and the oil company know that the contractor must show a profit if he is to maintain the healthy organization that he has today. The only way he can show a profit is to charge and receive a fair price. The only way he can receive a fair price is to bid soundly and intelligently. It would be well to summarize some of the elements the contractor faces in attempting to develop a bid that is low enough to gain him the contract but high enough to show him a fair profit.

The bid determines the final remuneration that the contractor will receive for his services. It must therefore be a bid that has been developed with the full knowledge of what its conditions cover.

The request for bids issued by the operator contains the well specifications that the contractor must know to prepare his bid. However, there is considerable variation in what the operator requires the contractor to provide and the responsibility he asks him to assume. The contractor must study each bid request carefully, and take care to adjust his thinking to the realities of the work to be performed. There can be just as many hazards in a bid request as there are in the drilling of the well.

It is impossible to make an intelligent bid without a true knowledge of costs. Much time and effort has been expended in developing accounting procedures that show the contractor clearly and accurately where his money goes. There is no one basic cost accounting method used by the contracting industry, but most contractors are cost conscious and the majority can demonstrate their costs for each rig by days, by wells, and by areas. Cost analyses are receiving constant attention and study, which is necessary in view of the earlier stated fact that the price per foot today is practically the same as in 1941. Although true costs are the basic requirement in the development of a bid, there are other important items that the contractor must know in order to bid soundly. He must know his areas and be able to differentiate classes of work and classes of wells. The contractor will have complete well information including mud records, bit performances, hazardous zones, etc., in areas where he has worked. In a new area the contractor faces a more difficult problem but may, in most cases, receive aid from the operator by checking company-owned records.

Most contracts let today are of the bottom hole or footage type wherein the contractor is paid for each foot of hole he drills. The typical contract of this type releases the contractor from the footage part of the agreement after he has successfully placed the water string in the hole. Therefore, the contractor must estimate at the time he develops his bid how many days he will spend under the footage part of his contract in order to arrive at his total estimated costs. The profit that the contractor anticipates making on a well is nominal in comparison with his total estimated costs. Hence, his anticipated costs must be carefully considered.

The knowledge of true costs is a matter of good accounting procedures, but the risk factor on a well is another matter. There is no possible way of knowing how much time will be consumed fishing, fighting crooked hole, or combating lost circulation. It is only too apparent that any one of a number of hazards may arise to completely destroy a contractor's estimate and, therefore, his anticipated profit. It is an absolute necessity that the contractor face his problem in a realistic manner. He must have the cooperation of the oil operator to bid soundly. Such cooperation is fully recognized by the oil business to be of mutual benefit to both parties.

● **Conclusion.** The contracting industry is drilling the majority of wells in the United States today. They are being drilled 15 per cent faster than in 1941 due to improvement of equipment, technique, and personnel. Educational and experimental programs that benefit the entire oil industry are being initiated at considerable expense to the contractor in order to further increase drilling efficiency.

Since 1941, contracting costs have increased approximately 40 per cent and revenues per ft have declined an average of 2 per cent. This economic condition within the industry demands sound bidding with close analyses of true costs, type of wells, and risks involved.

The contractor is a recognized and integral part of the oil business equipped and staffed to drill wells without restriction as to area or depth, and meet the rigid requirements of modern day drilling.

● **Acknowledgments:** The author is grateful for the assistance in the preparation of this paper to Ralph W. Marshall, Drilling and Exploration Company, Los Angeles, and E. C. Brown, Brown Drilling Company, Long Beach, California.

● **References**

1. "Economic Trends in Contract Drilling," J. E. Warren, 7th Annual Meeting, American Petroleum Institute, Chicago, Illinois.
2. "Drilling Contracting Situation," R. L. Dudley, *World Oil*, October, 1947, page 63.
3. Dudley, R. L., Idem.

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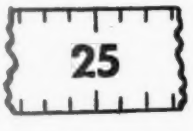
Folding Rule Kink

By W. F. SCHAPHORST

SAID one mechanic to another, "Show me any inch of any folding rule, regardless of the length of the rule, and I will tell you how long the rule is."

Mechanic No. 2 didn't immediately understand what Mechanic No. 1 meant, but after it was made perfectly clear to him it seemed incredible and so, being a betting man, he offered to wager $2 that he could "fool" Mechanic No. 1. The bet was promptly accepted.

So Mechanic No. 2 went away and soon came back with a small portion of a rule having a 25 on it, as indicated in this rough sketch. He had the remainder of the rule in a bag to prove to Mechanic No. 1 that he wasn't cheating.



Mechanic No. 1 took the piece of rule, noticed that there was a 47 on the other side, added the two, and the answer is 72, which means, "72 inches." In other words it was a 6-ft. rule. It is a fact that, regardless of their length, since folding rules are always "doubleheaders," the sum of the two opposite numbers always gives the length of the rule.

Mechanic No. 2 was dumbfounded until the method was explained to him. He then offered to pay the $2 saying that the lesson was "worth it." But Mechanic No. 1 refused the money because as he said, "I was betting on a sure thing."

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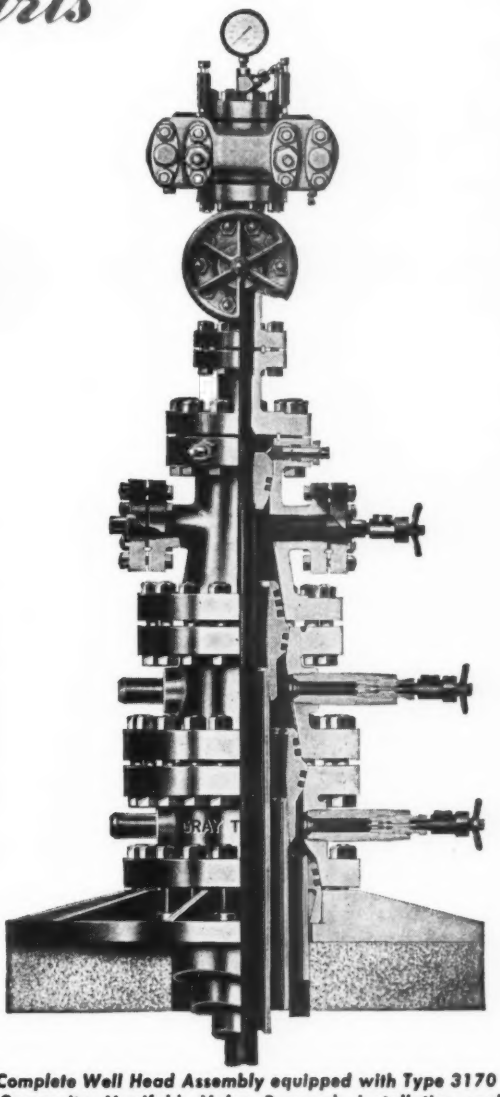

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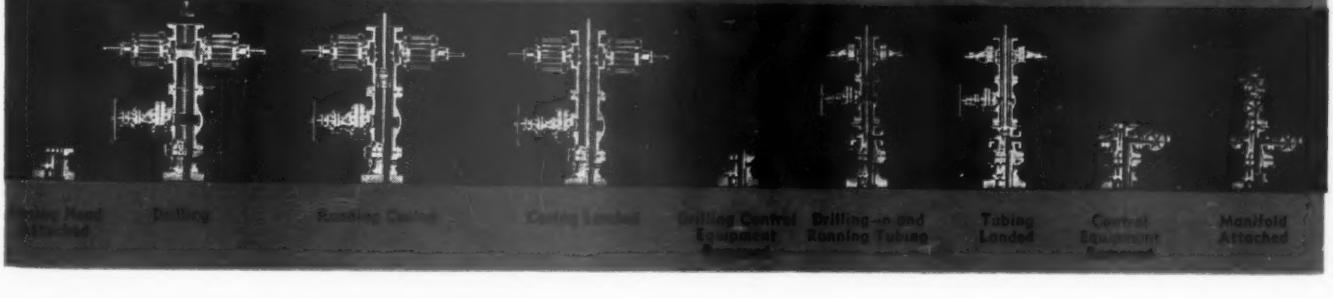

running tour with men in the industry

▸ **H. D. Hobson** has been appointed supervisor of exploration for California operations of the General Petroleum Corporation, it was announced by C. M. Wagner, director of exploration. He will be at the home office in Los Angeles.

Hobson studied at Oregon Agricultural College (now Oregon State College) and later received his degree in geology from Stanford University. Hobson joined General Petroleum in 1940 as a senior geologist in the San Joaquin Valley after 13 years' experience in oil geology in California.

▸ **H. K. Browning,** general sales manager, and **L. T. Wold,** controller, have been elected vice presidents of Kobe, Inc., according to C. J. Coberly, president and general manager. Both men have also been given added

H. K. Browning L. T. Wold

responsibilities, Browning being made assistant general manager, and Wold placed in charge of operations and finance.

Browning is widely known to oil producers of the West and Mid-Continent, having been engaged in oil equipment selling since 1932. He joined the Kobe organization in 1940 as sales manager at Tulsa, Oklahoma. He was trained as an engineer at Cornell before going into sales work.

Wold joined Kobe in 1946 as controller. A graduate of the Stanford Law School in 1926, he specialized in tax work, and engaged in investment banking until 1940, when he joined the U. S. Steel Corporation. In 1946, he accepted controllership of Kobe.

▸ **William Hurst,** senior exploitation engineer with the Shell Oil Company, Inc., has resigned to become a petroleum consulting engineer in Houston. He is a 1928 graduate of the Massachusett Institute of Technology, with a B.S. and M.S. in the School of Chemical Engineering Practice. Following graduation, he was employed by the Humble Oil and Refining Company until 1942, when he resigned to join Core Laboratories, Inc., Dallas, Texas. In 1943 he went with the Shell organization.

Hurst, a registered professional engineer, has had considerable experience in reservoir studies, and is one of the earliest contributors to water drive studies.

▸ **Franklin S. Crane** has been promoted to division engineer for Oil Well Supply Company's California Division it was announced by **Warner F. Parker,** division manager for this U. S. Steel subsidiary. Crane, whose headquarters will be at Los Angeles, succeeds S. C. Fietinghoff, retired. A 1943 graduate of the Colorado School of Mines with a degree in petroleum engineering, Crane joined "Oilwell" in 1946.

▸ **S. T. Ratliff** has been made district manager of Mid-Continent Supply Company in Los Angeles, California, where he will handle the export and West Coast business. Ken W. Davis, president and general manager, made the announcement.

S. T. Ratliff

Ratliff, former manager of Mid-Continent's store at Gainesville, Texas, has been with the company since 1942, except for a year and a half in the Army. Before coming with Mid-Continent, he was employed by National Supply Company and Industrial Supply Company.

▸ **J. H. Osborne** has been made division gravity meter supervisor for Stanolind Oil and Gas Company with offices at Casper, Wyoming. Osborne was a gravity meter party chief for nearly four years. He has a BS degree in civil engineering from Texas Technological College and has been with Stanolind since December 1944.

Osborne has had a varied experience in gravity meter work.

▸ **S. F. Shaw** of San Antonio will conduct gas-lift investigations, and make estimates of future reserves for various companies in the Turner Valley field, Canada, during September and October.

▸ **E. O. N. Williams** of Richmond, Virginia, has been selected as president of the Virginia Liquefied Petroleum Gas Association, which was organized only recently.

Foreign visitors at Houston Nomads' September meeting: *Kraus Earhart, Texas Company, Houston; Delvert Lewis, Foreign Exploration Company, Venezuela; S. Priulli, Jr., Cia Itatig, Brazil; Glenn Byers, Shell Oil, Houston; H. Pallares, Ecuadorian counsel, Houston; L. H. J. Hirch, Caribbean Petroleum Company, Venezuela; Orlando L. Prioli, Cia Itatig, Rio de Janeiro, Brazil; A. J. Pounds, U.B.O.T., Trinidad; H. R. George, Shell, England; R. S. Schols and H. Swolfs, B.P.M, Holland.*

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4. **MAXIMUM PENETRATION** of bullets into the formation, as proved repeatedly in competitive field tests.
5. **GUNS TO FIT EVERY CONDITION.** McCullough employs more than 30 different types and sizes of guns.
6. **ALL SIZES OF BULLETS** from ½" dia. up to ¾" dia., to fit every possible need.
7. **BURRLESS BULLETS,** giving a completely burr-free hole, eliminating casing scraping, with *no* sacrifice of penetration.
8. **NO LOST TIME.** McCullough's simpler, lighter equipment cuts setting-up and moving-out time, speeds up every job.
9. **EXPERIENCED MEN.** With years of experience behind them, thoroughly-trained McCullough gun-perforating crews do their jobs quickly, efficiently, safely.

These Are Some of the Reasons Behind the Proven Fact That

McCullough

PUTS THE SHOTS WHERE THEY COUNT

McCullough TOOL COMPANY
5820 South Alameda St., Los Angeles 11, California
405 McCarty Avenue, (P. O. Box 2575) Houston, Texas

26 SERVICE LOCATIONS

TEXAS: Houston, Alice, Cisco, Corpus Christi, McAllen, Odessa, San Angelo, Tyler, Victoria, Wichita Falls
OKLAHOMA: Oklahoma City, Guymon
Healdton
MISSISSIPPI: Laurel
NEW MEXICO: Hobbs
KANSAS: Ulysses
CALIFORNIA: Los Angeles, Avenal, Bakersfield, Ventura
MONTANA: Cut Bank
LOUISIANA: Houma, Lake Charles, New Iberia, Shreveport
WYOMING: Casper

EXPORT OFFICE 30 Rockefeller Plaza, New York 20, N. Y.

▸ **M. J. McLaughlin,** retired Magnolia executive and pioneer oil producer, died September 21, 1948, at his home at 6702 Lakewood Boulevard in Dallas, Texas. Mr. McLaughlin was 70 years old at the time of his death.

M. J. McLaughlin

Born March 17, 1878, at Petrolia, Pennsylvania in the heart of the Pennsylvania oil fields, Mr. McLaughlin was engaged in the oil business for 45½ years before his retirement January 1, 1944 as vice president and manager of the producing division of Magnolia Petroleum Company.

M. J. McLaughlin began his career in the petroleum industry with the South Penn Oil Company in West Virginia in July, 1898. He came to Texas in 1912 to become district production superintendent in the newly discovered field at Electra. In 1914 he was made division superintendent, and in August 1919 he was promoted to assistant manager of the producing division with headquarters at Dallas. He was elected a director of the company in 1930, and the next year, 1931, was elected vice president. In April 1932 he was made manager of the producing division.

▸ A party headed by **C. F. Teichmann,** vice president of Texaco Development Company, is now in Europe studying Continental petroleum and refining methods. Included in the party are **H. V. Atwell,** supervisor of fuels research at The Texas Company's Beacon, New York, research center and **B. Y. McCarty,** assistant director of technical service for The Texas Company Research and Technical Division in New York.

▸ **J. B. Fairfield,** general manager of the Great Lakes Refining Company, a division of Petco Corporation, has resigned his position.

▸ **Ken W. Davis,** president and general manager of Mid-Continent Supply Company, main offices in Fort Worth, Texas, has announced the personnel for Mid-Continent's new store at Duncan, Oklahoma, that will take care of new activity in that area.

The store, will be managed by **J. H. Mackey,** former store manager at Eunice. Field salesmen are **W. E. Levell,** formerly at Gainesville and **Bill Thornton,** formerly at the Sundown store. Other personnel includes **B. J. Hickman** and **H. V. Harris.** The store is under the supervision of **N. W. Dail,** district manager at Wichita Falls.

▸ **J. W. Bozeman,** vice-president of Tubular Service and Engineering Company (Tuboscope), Houston, Texas, announced the addition of a Tubing Caliper Service by his company.

The Tuboscope Tubing Caliper Service will feature the Kinley Caliper which incorporates a number of improvements for accurately surveying tubing in wells, such as simultaneous determinations of rod wear and corrosion plus increased speed of making a complete survey, according to the announcement. First field service has been established in Kilgore, and Tuboscope has immediate plans to extend the new service to other areas.

▸ **J. F. Ginna** has been appointed assistant to the vice president in charge of production of the American Car and Foundry Company, and will handle the scheduling and coordination of production.

J. F. Ginna

Ginna, who has been associated with ACF for over 30 years, was born and educated in Brooklyn, New York. He served in the Navy in both World Wars and was released from active duty in 1946 with the rank of captain, USNR.

▸ **Laurence E. Ferguson,** Tulsa, Oklahoma, is now with The Wheland Company. He formerly was with Franks Manufacturing Corporation and Lucey Products Corporation. In recent weeks he has been visiting the trade in Kansas and Colorado.

▸ **Philips B. Patton,** previously West Coast sales and engineering representative for the mobile communications division of Farnsworth Television and Radio Corporation joins Lenkurt Electric Company, San Carlos, California, as a field engineer in the carrier division. Widely known in the communications field, Patton was a featured speaker at the 1947 AAR (Association of American Railroads) communications section convention. Before going to the Coast he was technical coordinator for the same Farnsworth division in Fort Wayne, Indiana.

Philips B. Patton

Prior to that, he was on the technical staff of FCC (Federal Communications Commission); a flight radio officer on the transpacific clippers of Pan American Airways, and associated with the Western Union Telegraph Company in the Pacific division. A native of California, he attended University of Maryland and San Francisco State College.

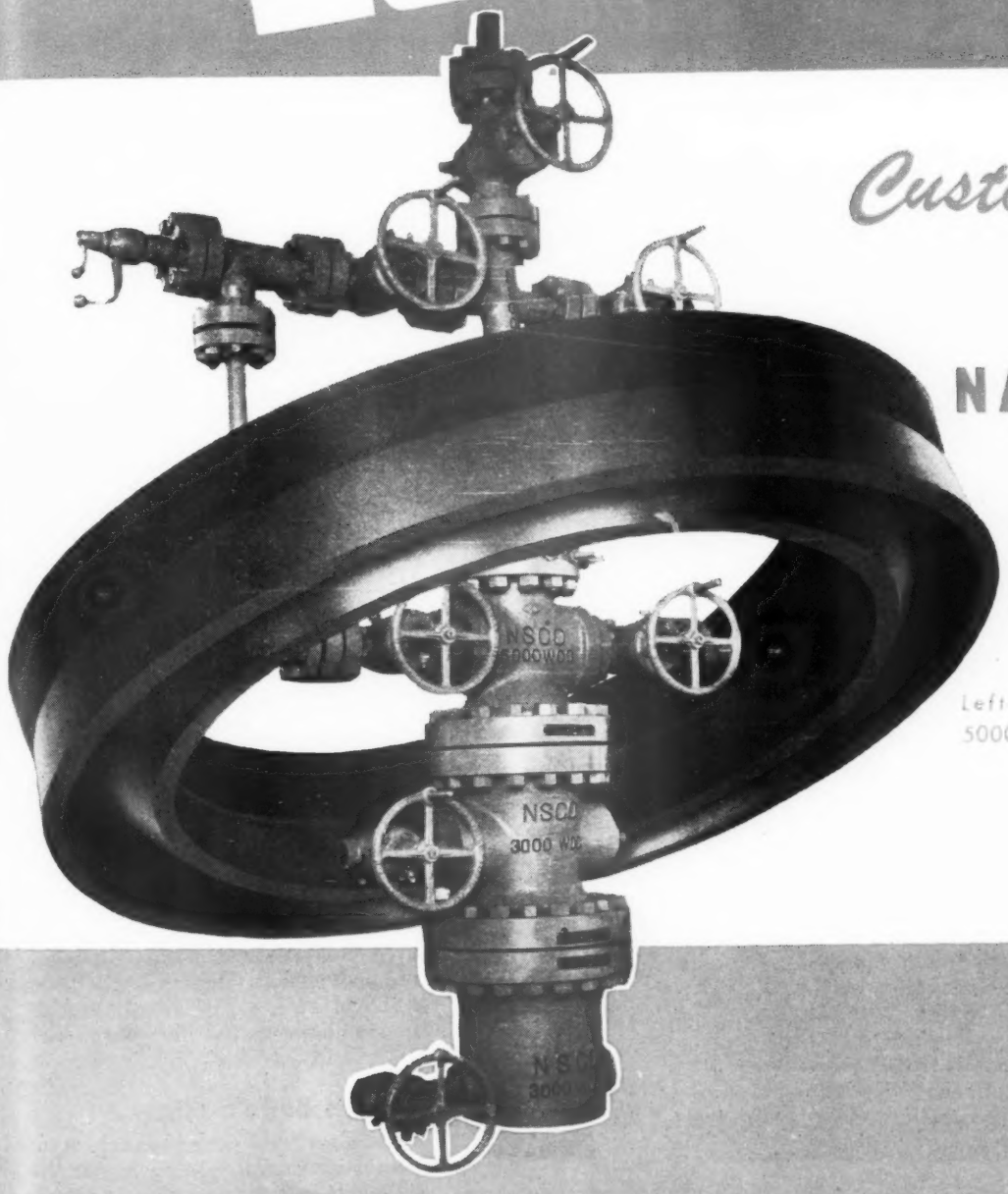
▸ **W. E. Largey** has been placed in charge of all advertising for the Oil Tool Division of Byron Jackson Co., Los Angeles. He replaces C. W. Smick who will devote his entire time to the advertising program of the Pump Division of Byron Jackson Co.

Largey has been associated with the Patterson-Ballagh Division of Byron Jackson Co. for the past year, and will continue to maintain offices at 1900 East 65th Street, Los Angeles, mailing address, P. O. Box 2493, Terminal Annex, Los Angeles 54.

Edwin L. Cox, Cox and Hamon, Dallas oil producers, was named Dallas Oil Progress Day committee chairman. The committee here conferring are, left to right, Fred F. Murray, Oil Well Supply Company, district information committee chairman; J. L. Latimer, president, Magnolia Petroleum Company; Cox, and John P. Morgan, Sun Oil Company, committee vice chairman.

Murray Rubber

CASING SEAL RINGS



Custom Built FOR NATIONAL WELL HEADS

Left—A National, 3000-5000 lbs. Working Pressure, Christmas Tree.

The success of any well head depends largely on its ability to effect and maintain a pressure-tight seal of the casing annulus. Failure at this point would result in the equalization of casing pressures, which could (and often does) result in costly remedial operations.

National engineers, recognizing the need for completely dependable well head seals, have entrusted Murray Rubber with the job of producing them.

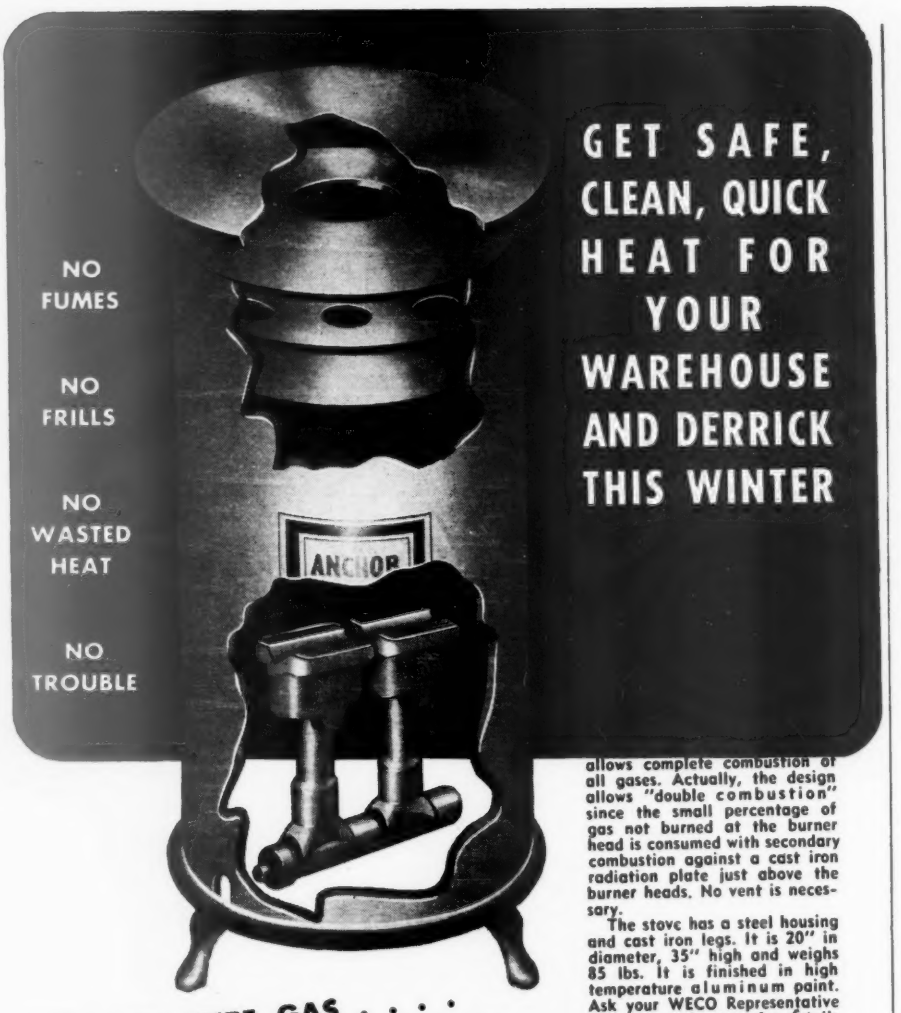
Whatever your molded rubber requirements may be, Murray engineers will gladly consult with you on how your product can be improved. Experienced oil tool design engineers, together with rubber compounding and molding technicians with nearly a quarter-century of specialized experience to their credit, are at your disposal.

The Murray Tool and Mold Division, which is operated as a part of the Murray Rubber Company, is dedicated to the production of customer's molds, metal inserts, dies, fixtures and other precision machine work to relieve the customer of these production details.

Make Murray your rubber supplier, too!

MURRAY RUBBER COMPANY

HOUSTON, TEXAS


NO FUMES
NO FRILLS
NO WASTED HEAT
NO TROUBLE
GET SAFE, CLEAN, QUICK HEAT FOR YOUR WAREHOUSE AND DERRICK THIS WINTER
ANCHOR
allows complete combustion of all gases. Actually, the design allows "double combustion" since the small percentage of gas not burned at the burner head is consumed with secondary combustion against a cast iron radiation plate just above the burner heads. No vent is necessary.
The stove has a steel housing and cast iron legs. It is 20" in diameter, 35" high and weighs 85 lbs. It is finished in high temperature aluminum paint. Ask your WECO Representative or your supply store for details of this unique new heater.
SPECIFY TYPE GAS . . . . NATURAL, BUTANE, PROPANE, OR MANUFACTURED
BOILER BURNERS
ANCHOR GAS BURNER
THE BURNER WITHOUT AN EQUAL
BUY THE BEST . . . . BUY WECO PRODUCTS
WECO
WELL EQUIPMENT MFG. CORP.
Subsidiary of Chiksan Company
Houston 1, Texas
Exclusive Sales Representative Outside Mid Continent Area:
CHIKSAN COMPANY
Brea, Calif. New York 7
Export Sales: CHIKSAN EXPORT COMPANY, Brea, Calif. New York 7
Manufacturers and Distributors of Oilfield, Refining, Marine and Industrial Equipment

Adds two heavy rigs

L. J. Maxwell, president of M & M Drilling Company, has recently purchased two more heavy power rigs for expanding his company's drilling operations in the Gulf Coast area of Texas, Louisiana, and Mississippi. He organized M&M Drilling Company in 1943 and headquarter offices are now in the Mellie Esperson Building, Houston, Texas. He operates 12 rigs from field offices in Jennings, Louisiana. One of these is a large steam rig. The others are power rigs, some of which are capable of drilling wells 12,000 to 15,000 ft deep.

L. J. Maxwell

Visit wild Leduc well

H. John Eastman, president of Eastman Oil Well Survey Company, Gordon Jackson, vice president and general manager, John Duncan, sales department, and Hal Benson, advertising manager, were recent visitors to the Leduc Field near Edmonton, Alberta, where Eastman engineers are in charge of several major directional drilling and survey jobs.

One of the more spectacular jobs just completed was the supervision of the directional work on the south relief well for the control of Imperial's wild Atlantic No. 3. Due to this relief well's location, prevailing north winds caused innumerable shutdowns for as much as 18 hours at a time when gas was blown from the wild well toward the boilers. Bits were stuck on bottom when the sudden wind change suspended drilling, and a 25-day fishing job when the drill string parted delayed completion of the south relief well until shortly after the ignited wild well had been extinguished through the simultaneously drilled west relief well.

Reopens Buffalo office

The Crocker-Wheeler Electric Manufacturing Company, division of the Joshua Hendy Corporation, Ampere, New Jersey, has reopened its Buffalo branch office in the Ellicott Square Building, Buffalo, New York. The new Buffalo branch, operating directly under the New York district manager, is headed by Louis E. Rau. A graduate of the Newark College of Engineering. Rau comes to Buffalo after several years on the staff of the New York district office. The telephone number of the new branch office of Crocker Wheeler is Mohawk 3828.

HANDY

Uncle Sandy

Courtesy
Service
Dependability

UNITED SUPPLY
AND *Manufacturing* COMPANY
TULSA, OKLAHOMA
Stores in Kansas, Oklahoma, Texas,
Louisiana, and New Mexico

Transfer store managers

The Continental Supply Company has announced the transfer of F. Vincent, former floorman at Lake Charles, Louisiana, to Eunice, Louisiana, as store manager succeeding R. E. Scheibel. The latter has been transferred to Lake Charles, Louisiana, as store manager, succeeding V. U. Pennell who has resigned.

P. D. Stearns, former bookkeeper at Monahans, Texas, has been appointed store manager at the same location, succeeding J. T. Green who has been transferred to the Rocky Mountain District. All changes became effective September 1.

Friction-free
Roller Bearings
+
Accurately
Machined Gears
+
Electrically
Welded Structures
=
Lower Production
Costs with Jensen
Pumping Units

JENSEN
BROTHERS MFG. CO.
Coffeyville, Kansas, U. S. A.
Export Office: 50 CHURCH STREET
NEW YORK CITY

Nomads meeting draws foreign visitors

Guests from foreign fields at Los Angeles meeting, standing: Rags Ragland, N. V. Nederlandsche Pacific Petroleum; D. C. Hannill, Ecuador Oilfields; Elmer Nunez, Mene Grande; Paul F. Schlageter, Arabian American; sitting: E. N. B. "Red" Ayres, Socony, Spain; D. T. "Tony" Gheno, Richmond; L. W. Evinger, Socony.

Lee Laird (right) initiates John Page and Mel Cooper into membership in The Los Angeles Chapter of Nomads.

Members of the Los Angeles chapter of Nomads held their regular monthly meeting at the Jonathan Club, Los Angeles, on the evening of September 8, with Fred Ripley in the chair and a goodly gathering in attendance including many guests from foreign lands. The group enjoyed an intimate dissertation by Harold Hatton on what goes on behind the iron curtain. Hatton, just returned from a visit to Moscow, gave an interesting description of his adventures in the city of the Kremlin, and thereafter was the subject of a long sustained barrage of questions which he took care of very skillfully.

During the evening, two new members, John Page and Mel Cooper, were fittingly initiated by Lee Laird, and Earl Boggess disclosed plans for a fall party to be held on the Union Oil Company picnic grounds at Brea, Saturday evening, October 23, 1948, beginning at 6:30 p.m. The particulars of this fracas had not at the time been fully worked out, but from what had already been programmed it was quickly assuming the proportions and character of a junior whing ding.

Marti returns to S. A.

Ernest J. Marti, Independent Exploration Company party chief in charge of Colombia, South America, seismic work, has returned to Barranquilla, Colombia, after a six weeks visit in the United States.

Marti is a graduate of Michigan College of Mining and Technology. He has been employed since 1936 by Independent Exploration. As a U. S. Naval Lieutenant, he supervised seismic exploration on U. S. Naval Petroleum Reserve No. 4 at Point Barrow, Alaska. He has been in South America for Independent Exploration Company since 1945.

DIRECTIONAL SURVEYS

while you

DRILL

with S-S Non-Magnetic Drill Collar Rentals

Particularly advantageous in directional drilling the S-S NON-MAGNETIC DRILL COLLAR makes it possible to take directional single shot records *inside of the drill pipe.* It eliminates removing the drill pipe from the hole or raising the string off bottom to allow the surveying instrument to hang through a specially designed bit. You save rig time—You get more accurate records.

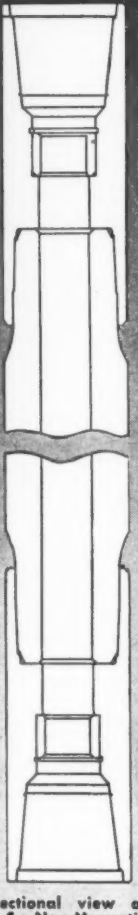
The S-S NON-MAGNETIC DRILL COLLAR is positioned immediately above the regular bit, the non-magnetic portion carrying the directional single shot instrument . . . *fully protected from loss and damage.*

Records are more accurate because the instrument is seated inside the drill collar in positive parallel to its walls.

The non-magnetic sections of S-S DRILL COLLARS are made of "K" Monel steel with the same high physical properties and strength found in conventional collars of steel.

S-S NON-MAGNETIC DRILL COLLARS are available on a low-cost daily rental basis in standard sizes from 4¾" x 14' to 7¾" x 23'.

Complete information and price list gladly furnished on request



Sectional view of S-S Non-Magnetic Drill Collar

LOW COST INSURANCE FOR YOUR PROTECTION
For the nominal sum of $1.00 a day renters are insured in case of loss up to ½ current sale price and ½ of accrued rental at time of loss.

★SURWEL SERVICE ★SYFO CLINOGRAPH ★E-C INCLINOMETER ★NON-MAGNETIC DRILL COLLAR

SPERRY-SUN

SPERRY-SUN WELL SURVEYING COMPANY

3118 BLODGETT AVENUE HOUSTON, TEXAS

Philadelphia, Pa. Falfurrias, Texas Odessa, Texas Marshall, Texas Long Beach, Calif. Oklahoma City, Okla.
Lafayette, La. Bakersfield, Calif. Moulden Oil Field Services, Casper, Wyo.

Humble personnel changes

The following promotions and transfers of production department supervisory personnel since August 15 have been announced by Humble Oil and Refining Company.

Delma Baucum, assistant district superintendent, Southwest Texas division, was transferred to the Wink district, West Texas division, replacing C. N. Hunt, Jr., who was transferred to the Pickton district, East Texas division.

Robert L. Pinion, Jr., senior civil engineer, East Texas division office, Tyler, was promoted to assistant division civil engineer, Southwest Texas division, Corpus Christi. He replaced Lloyd O. Zapp, who was promoted to senior supervising engineer, Civil Engineering division, Houston Office.

James L. Griffin, district clerk, Government Wells, was promoted to assistant district chief clerk at Scott and Hopper district. He replaced George B. Wells, who was promoted to district chief clerk at Government Wells.

Harry R. Barkley, district chief clerk, Kelsey District, was transferred to Southwest Texas as division material pusher.

Jack D. Brown, civil engineer, Odessa District, West Texas division, was promoted to district civil engineer replacing R. F. Carroll, who was transferred to the West Texas division office as office civil engineer. Robert A. Estes, former office civil engineer, was promoted to assistant division civil engineer, replacing Henry E. Meadows, who was appointed division civil engineer. Virgil A. Walston, former division civil engineer, was transferred to the Civil Engineering division, Houston Office, as senior supervising civil engineer.

A. J. Bedford, assistant division chief clerk, Southwest Texas, was promoted to division chief clerk of the West Texas division, Midland.

R. L. Rix, associate civil engineer, Houston Construction district, was transferred to Lovell Lake district, Gulf Coast Division, as associate civil engineer.

S. E. Holt, toolpusher, Conroe district, Gulf Coast Division, was transferred to the Friendswood district as toolpusher.

E. W. Howell, district transportation foreman, Friendswood district, was transferred to Galveston Bay district. He replaced M. H. Buchanan, who was transferred to the Freeport district as district transportation foreman.

J. R. Masterson, district civil engineer, Friendswood, was transferred to the Gulf Coast division office as senior civil engineer.

J. F. Baehr, office engineer, Southwest Texas, was transferred to the Civil Engineering division, Houston office, as civil engineer. He was replaced by O. L. Fontenot, formerly district civil engineer in the Hub District, Louisiana division.

Toolpusher I. D. (Slim) Wafer of Grand Isle, Louisiana division, was promoted to assistant district superintendent of his district, and W. A. Norris, also a toolpusher at Grand Isle, was transferred to the Freeport district. They were replaced by W. M. Satterwhite of Eucutta and C. L. Sparkman of the Bayou Sale district.

Four district superintendents in the Louisiana Division were transferred. J. C. Ott went from the Roanoke to the Eucutta district; R. B. Gustafson, from Eucutta to Sunniland; J. S. McKinstry, from Sunniland to Roanoke; and W. T. Dabbs, from Hub to Bayou Sale.

In the same division, three assistant district superintendents were transferred. They were J. C. Andries, who was transferred from Hub to Avery Island District; C. K. Seaman, from Avery Island to Sunniland; and S. E. Wallette, from Bayou Sale to Hub.

PAGE
TENSION
TOOLS
Announcing...
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TENSION TYPE
PRODUCTION TOOLS
at your
D + B and CONTINENTAL SUPPLY STORES
PAGE "TENSION TYPE" Production Tools—Tubing Anchors, Tubing Drains, and Sucker Rod On & Off Attachments—are available in the Mid-Continent through your nearest D+B and Continental Supply Stores. Check these new Tools. Get the full story on how Page Tools can cut production costs by keeping tubing in the hole longer!
PAGE TOOLS ARE different
TYPE "B" ANCHOR for ROD PUMP STRINGS: Page Type "B" Tubing Anchors set hydrostatically as the well pumps up!
TYPE "C" ANCHOR for MAIN AND PARALLEL STRINGS: Page Type "C" Tubing Anchors embody the same operation advantages as the Type "B" plus a special design for anchoring both main and parallel strings!
DRAIN AND BUMPER SUB COMBINED: Page Combination Tubing Drain and Bumper Sub affords a means of draining the tubing above the pump and can also be used as an effective up-jar!
ON & OFF ATTACHMENT for SUCKER RODS: Page's unique On & Off Attachment joins sucker rods to pump after tubing run-in—releases quick whenever desired!
Type "B" Tubing Anchor
Type "C" Tubing Anchor
Tubing Drain
On & Off Attachment
FIELD RECORDS PROVE . . .
. . . that anchoring the Page Way increases pump efficiency and decreases equipment wear —visit your nearest D+B Pump Store or Continental Supply Store — find out how Page "Tension Type" Tools can help you!
Mid-Continent Distributors
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The Continental Supply Company Dallas, Texas
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OIL TOOLS, Inc.
3356 Lime Ave., Long Beach 7, Calif.

Williams promoted

Buda Engine Sales and Service of Tulsa announces the promotion of Loyd E. Williams to manager of the company's western division, which embraces Colorado, Wyoming, and Montana. Williams has been successively manager of the company's Salem, Illinois, and Denver branches. He will continue to reside in Denver but will divide his time between Casper and Denver.

Loyd E. Williams

Other organization promotions include Art Holt from the Denver store to Casper as manager, Ben Culley from the Seminole store to Casper as sales engineer, and Henry Postlethwaite from the Great Bend store at Denver as sales engineer.

Service company expands

In a program of expansion that will carry its products and services into every oil operating area both at home and abroad, Oil Well Water Locating Company of Long Beach, California, announces appointment of the following distributors and representatives: Oklahoma, Kansas, and Arkansas—Allen Edwards, Inc., McBierney Building, Tulsa, Oklahoma; Gulf Coast and Louisiana—R. W. Bier, Commerce Building, Houston, Texas; Panhandle—Lee Flood, P. O. Box 1801, Midland, Texas; California—Technical Service Company, 2425 Gundry Avenue, Long Beach, California; Foreign sales representative, Atlantic—Harold Harmon, Room 424, 122 East 42nd Street, New York, New York. General sales manager at the headquarters office in Long Beach is Harry B. Poist.

This organization headed by Robert Funk, president and George Ennis, founder, is a pioneer in the development of well water locating instruments and processes, having been engaged in research relating to the problem for some 30 years. It has recently perfected a system of determining the water-oil relationships in lines, tanks, or any type of container or carrier, by measurement of high frequency impedance. This system, it is said, has proved effective in countless applications in field, tank farm, and refinery, and the expansion program is designed to make the method more widely available to the petroleum industry domestically as well as in foreign fields.

Bethlehem Supply changes

Bethlehem Supply Company wishes to announce various promotions and transfers in its sales personnel:

O. N. Wilson, formerly field representative at the Eldorado, Kansas, store, has been promoted to store manager and field representative.

C. A. Pigg, formerly store manager and field representative at the deactivated Bowie, Texas, store, has been transferred to the new Cisco, Texas, store in the same capacity.

Glen Cannon, formerly special representative at the Pampa, Texas, store, has been transferred in the same capacity to Artesia, New Mexico, and will concentrate his efforts on refinery equipment sales. Glen Cannon specialized in petroleum engineering at Oklahoma University and has had valuable refinery operative experience, being superintendent of several refineries over a period of four years before becoming affiliated with Bethlehem.

P. H. Jezzard, a trainee in the engineering sales department of the general offices, has been transferred to Casper, Wyoming, and promoted to district engineering representative.

Carl Taylor, field representative at Craig, Colorado, has been transferred to Casper, Wyoming, in the same capacity.

T. V. Ashabranner has been transferred from Kilgore, Texas, to Shreveport, Louisiana, and promoted to field representative.

H. L. Daniels, formerly field representative at Lake Charles, Louisiana, has been promoted to store manager and field representative at Lake Charles. Daniels had 14 years of oil field and refinery experience in the Louisiana Gulf area before becoming affiliated with Bethlehem 2½ years ago.

C. A. Claudet in the Harvey, Louisiana store and A. D. Waddell in the Odessa, Texas, store have both been promoted to field representative at their respective locations.

C. W. Henry has joined Bethlehem as a special representative and will work out of the Pampa, Texas, store. Henry has had 13 years of valuable experience in the supply business in North and West Texas and is well known in that area.

Baker opens new warehouse

Baker Oil Tools, Inc. opened a branch warehouse in Lake Charles, Louisiana, in the Corman Warehouse, Inc. building, Army Air Base. W. C. Wilson and H. E. Lyle will be transferred from Baker's Beaumont base to the new quarters.

A TRADE-MARK OF *Special Significance* TO YOU

MOST H.P. HOURS

WISCONSIN HEAVY-DUTY Air-Cooled ENGINES

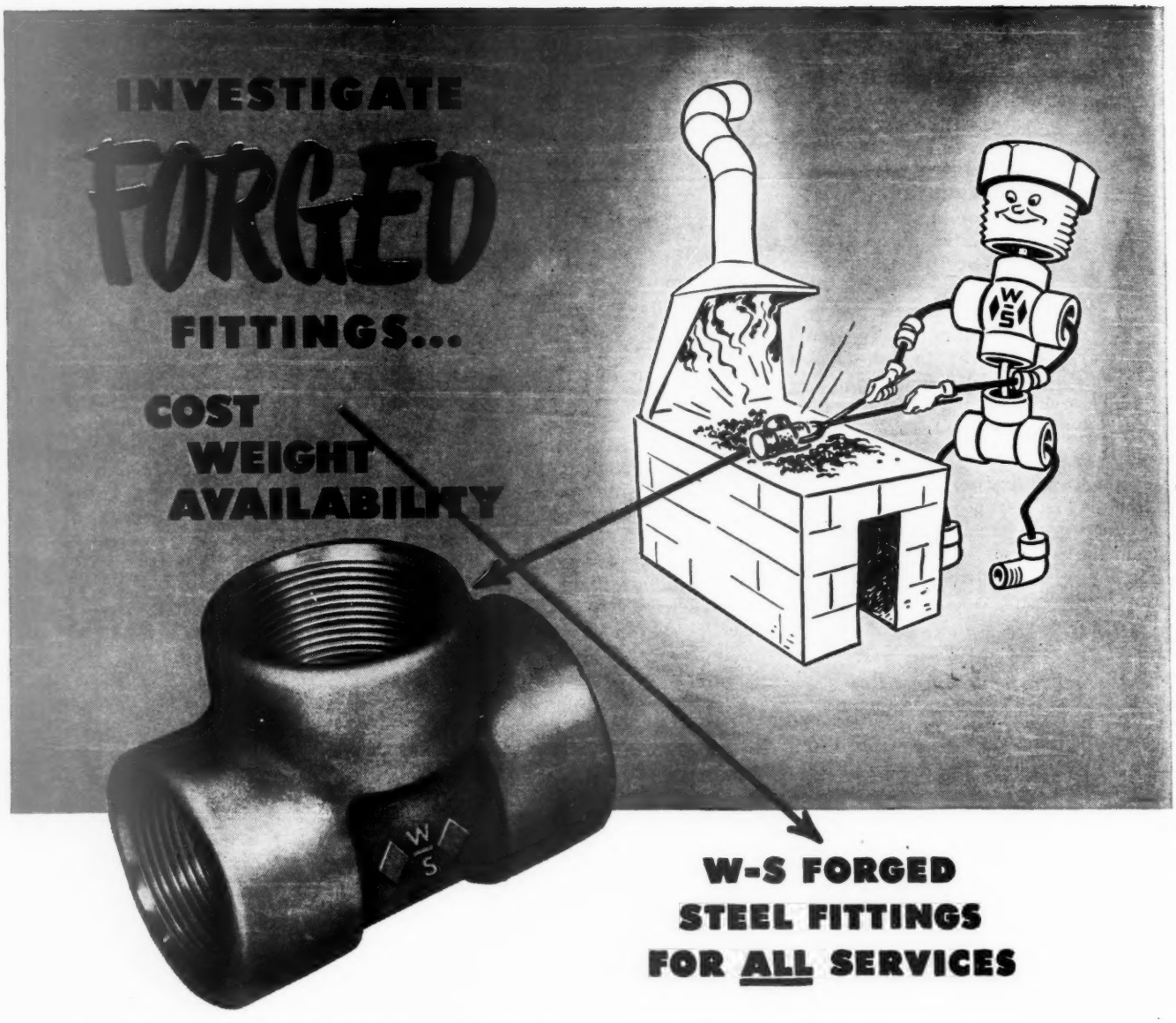
The recently adopted trade-mark reproduced above, an attractive decal of which is placed on every Wisconsin Engine that leaves our plant, should be of particular interest to you . . . as a manufacturer, designer, or user of engine-powered equipment.

"Most H. P. Hours," as applied to Wisconsin Air-Cooled Engines, is today establishing a new measure of engine value. Its significance lies in the fact that it accurately expresses the thing you pay for and in which you are most interested — *maximum horsepower hours of dependable, on-the-job service.*

It's a point well worth remembering, and acting upon.

WISCONSIN MOTOR Corporation
MILWAUKEE 14, WISCONSIN
World's Largest Builders of Heavy-Duty Air-Cooled Engines

WRITE TO HARLEY SALES CO.
510 Atlas Building, Tulsa, Oklahoma
M & M Building, Houston, Texas
Oil field distributors for Wisconsin Engines and all types of utility units.



W-S FORGED STEEL FITTINGS FOR ALL SERVICES

Now is the time to consider W-S forged steel fittings for *all* services.

The price differential between forged fittings and cast types is less than ever before. Remember, too, that tough, accurately machined, *forged* steel fittings pay for themselves many times over in greatly reduced maintenance and down-time. Service life is phenomenal. Just put them in and forget them.

Of course, you'd expect *forged* fittings to be stronger, but did you know that, service for service and size for size, they are smaller and lighter in weight than most cast types having only a fraction of their pressure rating?

W-S distributors are located in principal cities. Consult the one nearest you about the use of stronger, lighter, cost-saving Forged Fittings for *all* services. They're available for quick delivery.

CARBON STEEL
Low Sulphur, Low Phosphor
High Tensile, High Weldability

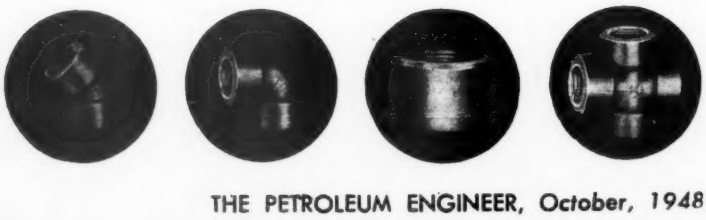
ALLOYS
Stainless types 304—316—347
Chrome Moly—Carbon Moly—
Chrome Carbon Moly—Monel
Special alloys for Low Temperatures

WATSON-STILLMAN

ROSELLE, NEW JERSEY

1848—CENTENNIAL—1948

SOLD THROUGH LEADING DISTRIBUTORS



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Recent Continental promotions

Five promotions in Continental Oil Company's production and drilling department have been announced recently. They are: Hugh L. Johnston, from division superintendent, West Texas-New Mexico division, Midland, to assistant region manager, Fort Worth. Harry Miller, from district superintendent, Big Spring, to division superintendent at Midland, succeeding Johnston. Garnett Plank, from assistant district superintendent at Wichita Falls, to district superintendent, Big Spring, succeeding Miller. Robert G. Parker, from district petroleum engineer at Seal Beach, California, to assistant district superintendent, Wichita Falls, succeeding Plank. Russell M. Hunter, from assistant to region manager, Fort Worth, to chief clerk of production and drilling department, Ponca City.

Johnston joined Continental as head roustabout at Warren, Texas, in 1929. Following advancements in Texas he was transferred to New Mexico and promoted to district foreman at Hobbs. He became division superintendent at Midland in 1943.

Miller, a graduate of Chillicothe Business College, came to Continental in 1927 as a telegraph operator at McKinney, Texas, and after several promotions became farm boss at Jal, New Mexico. He advanced to district superintendent at Big Spring, Texas, in 1942.

Plank studied at Oklahoma A&M College. Employed as a gas tester in the Texas Panhandle district in 1945, he became assistant district superintendent at Wichita Falls in 1946.

Parker, a Continental employe since 1939 when he was employed as a driller-derrick man at Ventura, California, received his BS degree in petroleum engineering from the University of California. In the Marine Corps during the war, where he advanced to the rank of major, Parker returned to Continental in 1946 and had advanced to district petroleum engineer at Seal Beach early this year.

Hunter, who studied at Rice Institute, was first a warehouseman when he entered Continental employment in 1923. He served in various advanced assignments in Texas until 1936, when he was transferred to Ponca City as production clerk. He went to Fort Worth in 1943 as assistant to region manager.

Ohio Oil executive dies

Clark S. Sherk, purchasing agent for The Ohio Oil Company, died of a heart attack on October 6 at his home in Findlay, Ohio. He was 61.

Mr. Sherk had been with The Ohio Oil Company for 31 years. He was graduated from Findlay High School and in 1917 entered the employ of the company. Advancing through the various positions in the purchasing department, he was made assistant purchasing agent in 1928, and advanced to purchasing agent and manager of the department in 1930.

USBM petroleum research

Operating from six field headquarters in the principal oil-producing areas of the United States, the Bureau of Mines plans to broaden its research on secondary recovery of oil in the current fiscal year and to increase the scope of investigations of new and more efficient refinery processes, according to Director James Boyd.

An allotment of $300,000 has been provided for 1949 for secondary recovery work and research in refinery processes, authorized under Public Law 443, (Synthetic Liquid Fuels Extension Act) approved March 15, 1948, Director Boyd stated. These research activities, conducted by the Bureau for many years, will be correlated with the diversified engineering field studies and applied and fundamental research supported by the Bureau's regular appropriations for oil and gas investigations which in 1949 total $606,000.

Oil-shale report available

A comprehensive technical report on the carbonization of oil-shale, prepared by a German expert, Dr. Walter H. Oppelt, is now available to the public, the Office of Technical Services, Department of Commerce, announces.

According to an introductory note, the report was written by Dr. Oppelt preparatory to signing a contract for employment in the United States as a means of indicating the type of information in his possession. The report, in typewritten manuscript form, has not had general distribution.

Dr. Oppelt was asked to draw up plans for two projects. The first project called for designing a commercial plant for the daily production of 8500 bbl of crude shale-oil, to include a suitable process for carbonizing the "fines" obtained from crushing and screening so they would not be wasted.

The second project Dr. Oppelt was asked to develop and report on involved the design of a pilot plant that in operation would provide basic information on various phases of commercial oil carbonization. The pilot plant designed calls for a highly flexible storage and disintegrating system to provide storage space for various types of oil shale, a transportation system, and furnaces for carbonizing the coarse shale and the fines.

Both projects as developed by the author are discussed in considerable detail in the 366-page report (PB-89704, *Carbonization of Oil Shale*). Photostat copies sell for $37. Microfilm copies are $7.

Also available is a related report (PB-89625, *Production of Liquid Fuels from Coal, Lignite, and Oil Shale in Europe*, 133 pages) which gives a general picture of European developments in the production of fuel from shale. The German author, Otto Hubmann, also discusses the applicability of European developments to the U. S. Raw materials available in Europe, technical methods used, the Lurgi carbonizer with gasification of residue, and economic and military aspects of European production, are discussed systematically in the report—14868, which is illustrated with several drawings, tables, and diagrams. Photostat copies are $14. Microfilm copies are $4.25.

Both of the reports are in English. Orders should be addressed to the Library of Congress, Washington 25, D. C.

Employe's club

As a further step in its broad policy of providing maximum recreational benefits for its employes, the Geo. E. Failing Supply Company of Enid, Oklahoma, manufacturers of oil field exploration and water well drilling equipment, has announced the purchase of an 11-acre plot of ground adjoining the city of Enid for a Failing employes club.

A club house is being erected that will provide all usual club facilities such as locker room, game room, kitchen, lunch room, and dance floor.

When completed the facilities will include a 5-acre lake, fed by deep well water, and which will be available to the employes for fishing, swimming, and boating. A sandy beach will be a feature.

Sun new district offices

Sun Oil Company has established new production district offices at Amarillo, Texas, and Roswell, New Mexico, in extending its search for new sources of crude oil in these areas, John G. Pew, vice president in charge of production, announced.

Acquisition of extensive acreage in these areas during the last year prompted the move as part of a plan to divide the West Texas-New Mexico area into geological provinces.

Both new district offices will be staffed by landmen and geologists and will be under the Dallas division of Sun's production department. A third district office in this area is at Midland, Texas.

The move is part of a general westward extension of Sun's exploration activities that began last March with the opening of a new division office at Denver, Colorado.

Simeon B. Christy, formerly of the Denver office, has been appointed manager of the Roswell district, and W. J. Hardy, former manager of the land office at McAllen, Texas, will be manager of the new Amarillo district.

J. E. Regent, former manager of the Midland district, will succeed Mr. Christy at Denver. Regent will be succeeded at Midland by Clarence M. Chase.

L. W. Storm and members of his geological staff will remain at Denver.

Other personnel changes resulting from the reorganization of the West Texas-New Mexico areas include the appointments of: J. B. Hamilton, district superintendent of production. will supervise production operations in West Texas and New Mexico from headquarters at Midland, Texas; E. L. Kownsler, production foreman in charge of Hobbs, New Mexico area; Pressley E. Langley remains at Roswell as assistant to Christy; Hans Winkler from Midland to Roswell as sub-surface geologist; Ross Ley from Dallas to Roswell in charge of general geological work, and Roy B. Lockett from Dallas to Midland as assistant to Clarence M. Chase.

Also, William H. Gray remains at Amarillo as assistant to W. J. Hardy; T. P. Braselton remains at McAllen. Texas, succeeding Hardy as manager of the land office there; Robert B. Totten from Delhi, Louisiana, to Amarillo as geologist. Totten will be assisted by Grady D. Herrington and Paul H. Horn, formerly of Monroe, Louisiana; E. D. Truex transferred to scouting, Roswell, New Mexico, district; H. Mercer Johnson transferred from Tallahassee, Florida, to Midland district scouting. He will be stationed at Abilene, Texas. J. B. Holstead, landman, stationed at Abilene under Chase, of Midland district, and Dana T. Whitton, field geologist, will be stationed at Abilene, Texas, under W. H. Conkling, district geologist, Midland, Texas.

To Canada

R. M. (Bob) Cook, vice president in charge of sales at Security Engineering Company, Inc., Whittier, California, announces the transfer of Arthur Nelson to Edmonton, Alberta. Canada, where he will serve as district manager in that area. Nelson was formerly sales and service representative at the Security branch office in Ventura, California.

This "Packaged Unit" is the combination of two engineering greats—the Leland Oil Field Truck Body plus the Tulsa Winch. This compact unit has received a hearty welcome wherever winching operations are required.

This unit is fabricated to standard truck wheelbases and shipped direct to you for easier "on-the-spot" field installation.

LELAND "LEADERS"

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Bucyrus Erie
Chicago Pneumatic Tool
Cleveland Trencher
Roebling Wire Rope
Tulsa Winch

"PARTS AND SERVICE"

Leland
EQUIPMENT COMPANY
OKLAHOMA CITY • TULSA • LONGVIEW, TEXAS

Horner transferred

Byron Jackson Co., Oil Tool Division, announces the transfer from Los Angeles to Houston of V. C. Horner. Horner will be assistant chief engineer of the Oil Tool Division in the Gulf Coast and Mid-Continent areas. His new duties will take him into the oilfields of that area where he will observe and report on the operation of BJ's line of oil field tools. He will also act as liaison between the engineering department in Los Angeles and the Houston shop where many of the BJ tools are made and repaired.

V. C. Horner

Horner is a graduate of Rice Institute and has spent seven years in the Los Angeles engineering department of the Byron Jackson Co.

Bethlehem changes

It is announced by John F. Eaton, vice president in charge of manufacturing, Bethlehem Supply Company, that H. A. Barnes, former assistant superintendent of the Tulsa plant, Tulsa, Oklahoma, has been named manager of the Tulsa plant, and that L. R. Estes former assistant to plant manager of the Corsicana plant, Corsicana, Texas, has been named manager of that plant.

Barnes, a graduate of Lehigh University in engineering, joined Bethlehem Supply in 1939 as sales engineer and was later transferred to the Tulsa plant, in which he served in various capacities.

Estes has long been connected with manufacturing work in Corsicana, having been a member of the original firm of American Well and Prospecting Company, later acquired by Bethlehem.

It was announced at the same time that the engineering departments of the Tulsa and Corsicana plants would be consolidated at Tulsa, under the direction of Harvey E. Davidson. Davidson, who has been with the company since 1941, was formerly chief engineer of the Tulsa plant. He is a native of Kansas and attended Kansas State College.

C. R. Zimmerman, executive vice president of Bethlehem Supply Company, announces that Lee Fagg, former chief engineer of the Corsicana plant, has been transferred to Tulsa to the position of manager of engineering sales, replacing B. F. Groenewold, who resigned.

Fagg, a native Texan, was graduated from Texas A. & M. College. His entire career has been spent in the oil well supply sales and engineering.

H. A. Barnes

L. R. Estes

H. E. Davidson

Lee Fagg

"Oilwell" changes

Three personnel changes in Oil Well Supply Company's West Texas district are announced by V. J. Waters, manager of this U. S. Steel Corporation subsidiary's Central Midwest Division.

Taylor E. Bowers, manager of "Oilwell's" Odessa, Texas, store, has been appointed assistant manager of the West Texas District, with headquarters at Midland, Texas.

Willis Blackwell, a veteran of 22 years with the company, who has been district warehouse supervisor at Odessa, since October, 1941, was named to succeed Bowers. Blackwell will be succeeded by Jerry L. Wall, storeman in the Olessa store since April, 1941.

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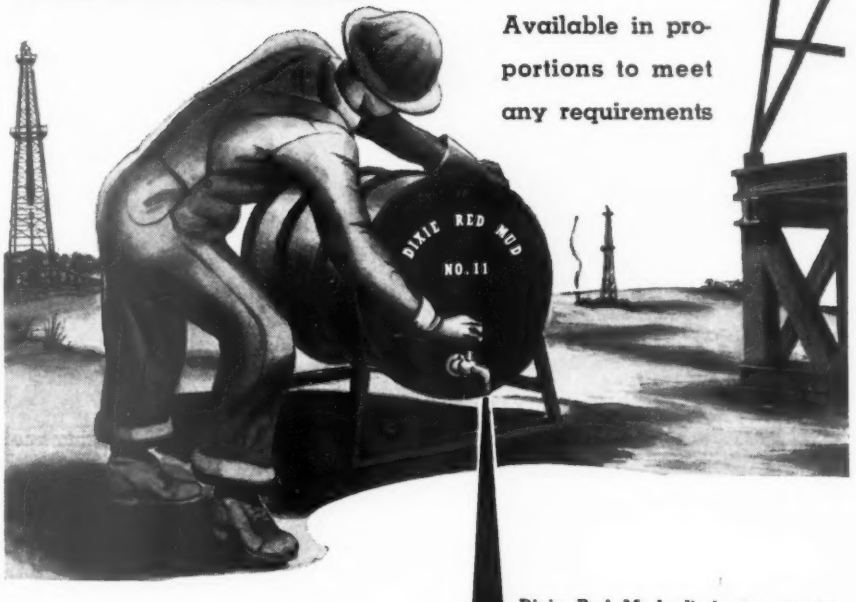
Liquid Mud Conditioner
Safe . . . Economical
Efficient . . . Convenient

Available in proportions to meet any requirements



Dixie Red Mud is a specially prepared mud treating chemical developed by the Dixie Chemical Co. It is a liquid alkaline tannate solution. Red Mud lowers viscosity, reduces water loss and aids in control of gel strength.

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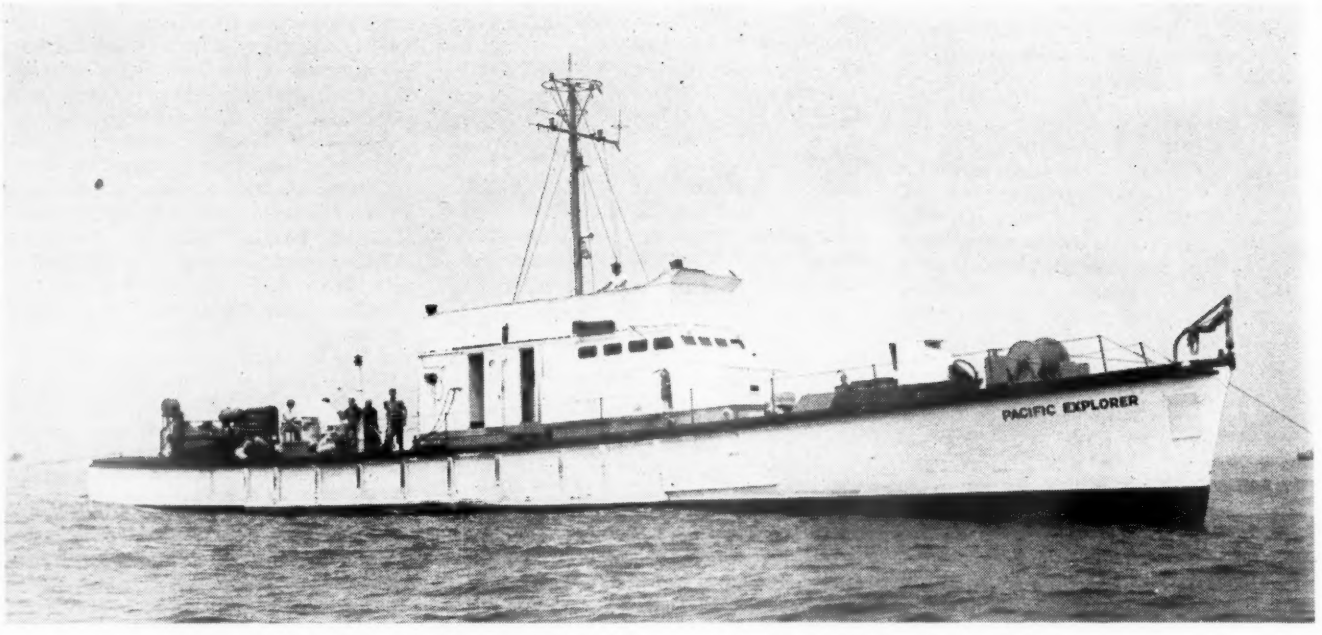


This is the Pacific Explorer, a converted sub chaser, that is now doing yeoman service as recording boat and traveling quarters for a geophysical crew now exploring the California continental shelf.

Offshore California Gets Geophysical Survey

By RICHARD SNEDDON, *Pacific Coast Editor*

THE continental shelf of the California coast is at the present time being given a thorough going-over geophysically in behalf of a combination that will eventually include all the major oil companies in the state and a substantial group of the larger independents. The purpose of the joint effort is to reduce to an absolute minimum the number of shots required to complete the survey, and thus conserve to the utmost the fish life in the area being explored. The pioneer companies in this unique venture were Shell, Union of California, and Continental, and they will be joined on October 1, 1948, by General Petroleum Corporation, Humble Oil and Refining Company, Standard of California, Tide Water Associated, Richfield, Honolulu, Signal Oil and Gas, Ohio Oil Company, The Texas Company, and Hancock. The actual seismic work is being performed by United Geophysical Company of Pasadena, under the direction of Flint Agee.

The continental shelves of the Gulf of Mexico and the California coast have long been touted by leading geologists as likely sources of petroleum reserves of sizable magnitude. There has really been no skepticism about the ultimate development of such sources should promising indications be found, but it has been pretty generally conceded that the special mechanics of drilling and producing from considerable ocean depths would require plenty of concentrated thought and planning before a definite program could be worked out. There have been many wells already drilled in California on piers extending from the shore for distances up to a quarter of a mile, but in the main their purpose has been to tap already known land structures. The prospect of drawing from new reservoirs at hitherto unexploited ocean depths opens up some interesting problems for the engineering genius of the industry.

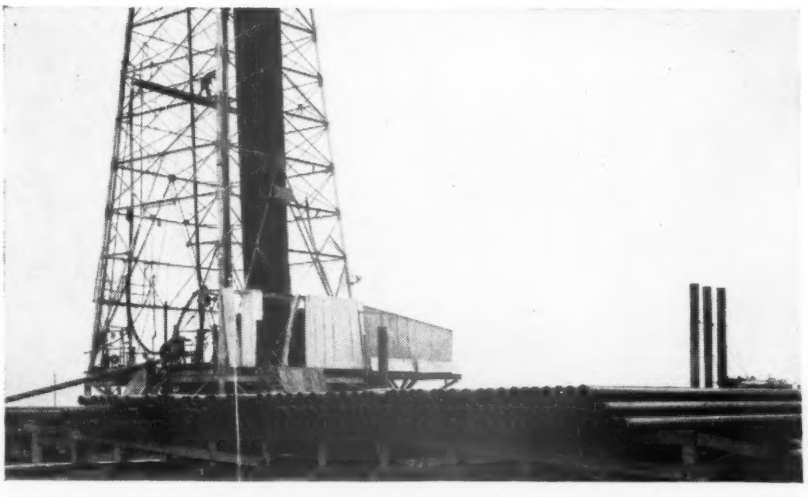
In the meantime, wells have also been drilled in Maracaibo at depths of 100 ft by building platforms set on pilings to carry the drilling rigs and all the essentials. Gulf Coast operators have successfully employed drilling barges in shallow areas that were not too exposed. All of which means that a fairish bit of progress has already been made in the establishment of techniques and the design of equipment for drilling wells at sea, and there is every reason to believe that the know-how of the operators will enable them to make such further advances as may be necessary to cope with the involved problems of ocean drilling, should the surveys warrant a drilling program. For the moment at least, it appears that the reflection seismograph has been well adapted to ocean surveys, so we are launching into a distinctly interesting era of petroleum exploration, even if we haven't quite perfected the details of production.

EXCLUSIVE

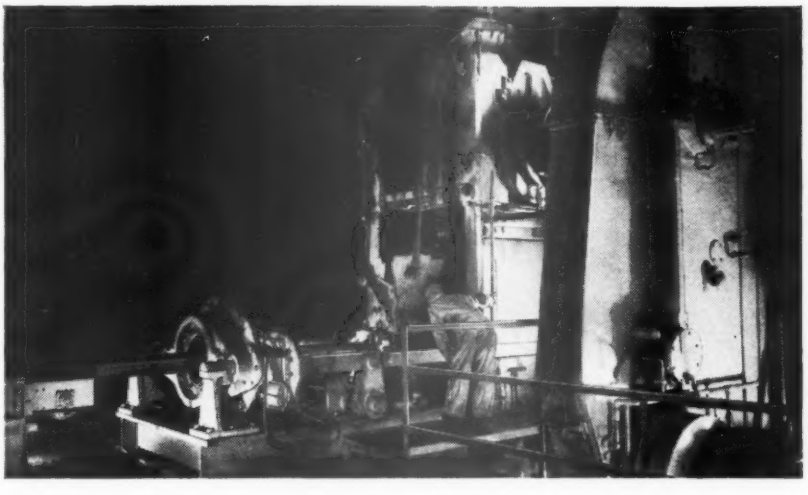
According to Norman J. Christie, the continental shelf in California is quite narrow, and from its edge dips rapidly to the floor of the ocean. In consequence, practicable exploration

DEPENDABILITY

THROUGH RESEARCH



IN THE FIELD, LOUISIANA: Running a 9200-foot string of 9⅝-inch S-80 SMITHway Casing.



IN THE A. O. SMITH PIPE MILL: Research developed this special Smith-designed cold compression machine for externally sizing SMITHway Casing.

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is confined to a comparatively narrow strip along the shoreline. Even within a five-mile limit, depths of 600 ft are not uncommon. The structural features sought in California are mainly sharply folded anticlines, with dips ranging from 30° to 60°, and associated faulting and pinch-outs, as compared with the salt domes, low angle reversals, and small dip closures against normal faults, found on the Gulf of Mexico. Shooters in both areas run afoul of the fishing industry, but the concerted venture in California, and the negligible damage that has resulted from the shots, should do much to create a better understanding, and to assure the fishermen that their livelihood is not being jeopardized by the momentary intrusion of the oil men.

About five years ago California had its first sea-going seismic survey. This was designed merely to determine the extent of trends already projected in known land structures. It was confined to ocean bed immediately adjacent to the shore, and there was thus no need for the survey crew to remain at sea beyond the normal daily working hours. Small boats without sleeping quarters were therefore quite adequate. Contrast that with the sleek looking Pacific Explorer, a converted sub-chaser, that is now home and workshop to a 23-man crew of geophysicists, and you have a slight idea of the way in which the business of sea-going seismic exploration has progressed in five years.

The total fleet actually consists of about six boats. A survey boat precedes the others by about a day, marking the section of ocean bottom to be explored with surface lines of red buoys. Then comes the recording boat, carrying the equipment and most of the personnel. From the stern of this one the geophone cable is paid out, the off end being held by the tail boat. A jetting boat plants deeply submerged charges, while the shooting boat sets near surface charges, and detonates all shots. The shooting boat carries charges, primers and blasting caps—well separated to avoid accident. It is interesting that the powerful explosives now used in seismic work cannot be exploded accidentally by dropping and are not even detonated by the impact of a rifle bullet. One extra boat is employed in California, incidentally, to perform miscellaneous services such as picking up any fish that are killed by the shots. Needless to say, this is the same craft that carries the inspectors of the State Fish and Game Commission.

The geophone cable is let out from the recording boat in spreads of 11 seismometers, spaced 100 ft apart, and floated on the surface; or they may be floated in groups of three with the same distance between, that is, three times the number of geophones, at-

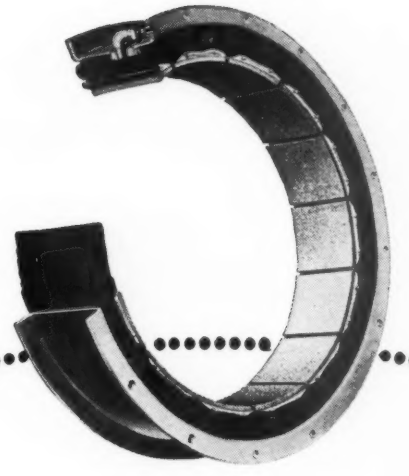
The crew strings out the geophones, half a mile of them, with the "jugs" spaced at 100 ft. The tail boat can be seen in the distance carrying the off end of the cable.

While J. Harmon and I. W. Buddenhaven take a bead on their respective shore markers with the sextants, surveyor Octavio Castro defines the area subject to the findings of the test.

Photos by Phil Bath, Los Angeles Times.

SHOCK ABSORBER...

FOR MAN ... AND MACHINE



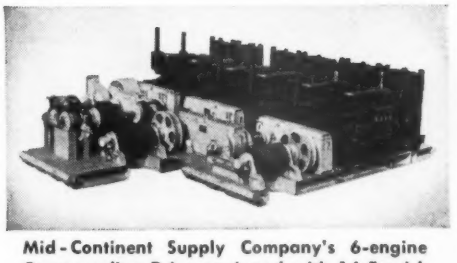
Pneumatic-tube Clutch Provides "Life Insurance" for Your Machines

Shock? Vibration? Not in modern drilling rigs equipped with Fawick Airflex Clutches!

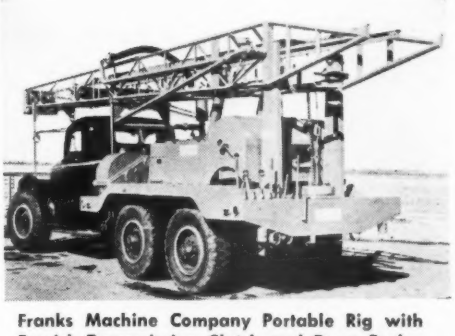
The Fawick Clutch transmits power through friction shoes carried on a rubber-and-cord tube actuated by air pressure. This flexible air cushion acts, literally, as a shock absorber and vibration cushion . . . protects the entire machine against needless wear and tear, prevents operator fatigue, gives perfect clutch control, perfect shock absorption.

Job-proved, Fawick Clutches meet the toughest operating conditions on mud pumps, engine and rotary table drives and hoist drums.

Avoid unnecessary parts replacement costs, needless down-time—always specify Fawick for your equipment.



Mid-Continent Supply Company's 6-engine Compounding Drive equipped with 14 Fawick Clutches.



Franks Machine Company Portable Rig with Fawick Transmission Clutch and Drum Brake.

Wilson Titan Rig with Fawick Conversion Pump Drive Clutch.

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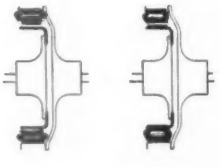
Compressed air expands the rubber-and-fabric tube to engage clutch with any degree of "grip" you want. Release the air and clutch disengages.



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Dallas de Caussin cradles one of the subsea geophones. They may be arranged 1 or 3 to 100 ft., depending on size and depth of the shot.

Michael McGillycuddy, is monitoring the controls of the recording machine, which picks up the shock pattern as it comes over the geophones.

C. H. Miller, the shooter, awaits the signal to fire the shot, while F. L. Nofer maintains contact with the recording boat by means of a radio short-wave phone.

Admiral of the fleet, Bill Brooks, is all set to give the "fire" order. Bill is a veteran explorer in the Mexican Gulf, and is widely experienced in seismic work.

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If it's your responsibility to "get the job done," we can help you do it quicker and easier.

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Ernie Etzold is preparing to drop the shot overboard. Note that it is attached to a balloon float by a length of cable which indicates just how far below the surface it will be suspended.

tached to special platforms and floated several feet under water. At first the shots were exploded right on the ocean floor, but it was found that the gas bubbles so formed interfered with the reflection effect. To eliminate this so-called "multiple P" effect, larger charges were used nearer the surface. Now when ocean floor shots are considered necessary or advisable, they are jetted from the stern of a well-anchored boat. Referring again to the cable, each seismometer or set of three is connected with the recording apparatus by means of insulated electric wiring, and about the middle of the cable is an upright marker that gives the shooter an indication of where his charge should be dropped.

When everything is ready—the seismometers in exact position relative to the buoys, the recording instruments set, the charge, primer, and blasting cap assembled—a standby order is telephoned from the recording boat. The shooting boat drops the charge and speeds away from the spot. When it is about 300 ft away, the order to fire comes from the recording boat. If the charge is exploded under fairly deep water no surface disturbance is evident. On the other hand, if it is placed in shallow water or floated on the surface, it throws up a spectacular fountain.

It is customary to orient the exact position of the shot by taking several beads with a sextant on land markers. This is usually done by the survey boat, but repeated surveys are taken just at the time the shot is fired to be sure that there has been no shift from position in the meantime. The position of the shot with relation to the geophone line is calculated from the first arrival times. As these first breaks always come through the water, it is no problem to establish the position of the shot along the line as well as the perpendicular distance between the line and the shot. Ordinarily the work of the seismic crews is not at all impeded by fog, the only thing that really interferes being unduly rough seas.

In general it may be stated that the seismic data acquired in this way on the California coast are of good quality, and a reasonable picture can be constructed from scattered dip shots or continuous profiling. Recent reports indicate that the three companies that originated the survey have been paying approximately $2500 for each of three small fleets engaged in this work. It is big money but the crews work fast. They have fired as many as 120 shots in a day, and no doubt when the other ten companies begin to take a hand on October 1, although the project will be expanded to take in the entire shoreline from Point Conception to Point Estero, the burden will be somewhat eased for the participating companies.

The field crew and the fleet are under the immediate command of Bill Booth, well known Gulf of Mexico explorer. As the data are collected they are taken to Montecito where a group of United Geophysical Company analysts led by Duncan Robinson, take care of the correlation. The entire project is a glowing example of the interest that the oil industry maintains in its own scientific and economic stability. Here we have 13 oil companies willing to risk substantial amounts of capital to exploit a bit of scientific speculation that has loads of support in theory, but nothing completely factual to assure its validity. It shows also the stuff of which oil men are made, for, if it takes a fortune to find out whether or not there is oil beneath the continental shelf of California, imagine what it is going to cost to bring it to the surface after we know for sure that it is there! ***

Thar she blows! This shot, composed of 200 lb of a new powerful explosive, EP-126, was set 14 ft below the surface, but it threw up quite a fountain.

PLUS *Quality* EQUIPMENT

The Continental organization was founded on the precepts that its success and growth depended upon giving the oil and gas industries a representative line of *quality* equipment . . . and good service. Continental's steady, yet unhurried, expansion has proved this policy's soundness.

Today "The Green Triangle" is a familiar—and looked for—sign throughout the oil country.

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GEOPHYSICAL ACTIVITIES

Jackson hole described

As an aid in the current intensive search for oil fields in the Jackson Hole area of northwestern Wyoming, a new bulletin has been issued by the Geological Survey of Wyoming, according to Dr. H. D. Thomas, state geologist and professor of geology at the University of Wyoming.

The material in the bulletin will be useful in solving problems arising in the management and disposition of federal and state lands which may yield oil and gas, Thomas said. Bentonite beds, also common in the region, are mapped in the bulletin.

The measured sections illustrated in the booklet, Thomas said, will be valuable in forecasting the depth to possible oil sands and in predicting the nature of rock sequence which will be penetrated in test wells.

The publication, entitled "Stratigraphic sections of Jurassic and Cretaceous rocks in the southwestern part of the Jackson Hole area, northwestern Wyoming," was prepared by J. D. Love, D. C. Duncan, H. R. Bergquist, and R. K. Hose, all geologists with the U. S. Geological Survey. The bulletin is available at the Geological Survey of Wyoming, Laramie.

Warren adds to staff

D. L. Connelly, president of Warren Oil Corporation, announced the addition of the following three men to the company's geological and land departments: B. L. Clark, formerly with Stanolind Oil and Gas Company, Tulsa, has been named district geologist with headquarters at Houston; Wesley Davis, formerly with The Chicago Corporation, has been made district geologist with headquarters at Corpus Christi, Texas, and Richard W. Fry, formerly with George W. Strake, has been made district land man with headquarters at Corpus Christi.

G. P. geological staff

Two changes in General Petroleum Corporation's geological department have been announced.

Representing expansion of G. P.'s exploration work in western Wyoming, Utah, and southwestern Colorado, Silas C. Brown has joined the company's offices in Durango, Colorado, as geologist. Brown comes to General from the U. S. Geologic Survey. He previously had two years service in Colombia. Lesh C. Forrest has been promoted to district geologist for the San Joaquin Valley district.

Meeting this month in California

The twenty-fifth annual joint fall meeting of the Pacific Section of the American Association of Petroleum Geologists, the Society of Economic Paleontologists and Mineralogists, and the Society of Exploration Geophysicists, will be held at the Huntington Hotel, Pasadena, California, on October 28 and 29, 1948.

The AAPG morning and afternoon sessions on Thursday and Friday will feature a series of papers on recent discoveries of new oil producing basins and new fields in California, together with reports on recent developments in Canada, the Rocky Mountain area, and Arabia. Programs for the SEG and SEPM will be announced shortly by their program chairman.

Among the highlights of the two-day fall meeting will be the Thursday luncheon, the dinner meeting of the SEPM on Thursday evening, and the formal dinner dance on Friday evening which will terminate the meeting

U. S. consultants aid Colombia's oil council

Oil exploration and production will be encouraged in Colombia via a new, healthy political climate, says David Donoghue, Fort Worth geologist, engineer and consultant to Felix Mendoza, president of Colombia's National Petroleum Council. Donoghue, with George H. Fancher, University of Texas, and W. L. Nelson, University of Tulsa; and Max Thornburg, advisor to the Sheik of Barien, have just returned from consultations with officials of the Colombian government.

David Donoghue

Alonzo Aragon Quintero, Minister of Mines and Petroleum, and Mendoza, graduate petroleum engineer, University of Oklahoma, are spearheading the movement of the government's progressive element to remove, during the present session of the Congress, legislative restrictions discouraging to oil operators.

Decreasing interest in Colombia on the part of foreign oil explorers led President Mariano Ospina Perez to recently authorize this panel of top consultants to make the study upon which the new legislation is based.

Laws governing ownership of mineral rights are so involved that extensive litigation, covering two years or more, is often required to process any concession for exploration on either public or privately owned lands, Donoghue pointed out. At present the title holder has a reasonable claim to ownership of minerals only in land acquired prior to 1873. All else is owned or subject to claim by the government.

This, agrees responsible Colombian officials, is a burden on the exploration for oil that should be dealt with in order that the country may gain a prominent position in the world oil picture.

Naval Reserve wants engineer

The office of the director, Naval Petroleum Reserves, which functions under the supervision of the Secretary of the Navy, has a vacancy for petroleum engineer with a basic knowledge of geological and geophysical prospecting for petroleum. The work includes study, analysis and correlation of technical field data, economic studies relating to the petroleum industry, periodic field trips, and consultant services to the director. This work will be performed under the supervision of an officer who is a qualified petroleum geologist and engineer, and a civilian petroleum engineer.

The director has under his immediate jurisdiction and control as delegated by the Secretary four petroleum reserves, two in California, one in Wyoming, and one in Alaska, and three oil shale reserves, two in Colorado and one in Utah.

An engineer applying for this position should have, in addition to a college degree in petroleum engineering or allied subjects, a reasonable amount (minimum of four years) of field experience including geology, geophysics, and production work, and should be able to qualify under Civil Service as a P-5 Petroleum Engineer. The present starting salary is $6,235 per year.

Any young engineer interested in this position should address a letter to: Director, Naval Petroleum Reserves, Room 1046, Building T-3, Navy Department, Washington, 25, D. C.

A — ALUMINUM BREAKER BOX — mounts 7 ft. below 1st girth. Provides electrical outlets with individual circuit breakers rated 20 amps at 115/125 volts A. C. or D. C.

B — VPL-G VAPOR-PROOF LAMP — 30° lamp line junction into Derrick leg cable. Note outer metal guard and protective inner glass globe.

C — GANG BOX — mounts 7 ft. below 1st girth. Provides six electrical outlets for Derrick light lines, extensions, etc. Sturdy metal housing with spring loaded covers.

D — TAP OFF BRANCH — used to connect "Fourble Board" line to cable on Derricks leg.

E — FSC FEMALE OUTLET — accommodates lamp socket (F) on Weather-Proof String-a-lite Assemblies molded of Neoprene into Derrick leg cable.

F — ERS LAMP SOCKET — used in FSC Weather-Proof String-a-lite Assemblies (see E). Accommodates standard Edison medium based bulbs.

G — B2A187M MALE PLUG — PUSH-LATCH style with Water-Seal. Hook type coupling connects easily, prevents accidental disengagement.

H — B2A187F FEMALE PLUG — PUSH-LATCH style with Water-Seal. Hook type coupling connectors easily prevents accidental disengagement.

I — VAPOR-PROOF FLOODLIGHT — 200 watt with rigid clamp for mounting. 7' cord has PUSH-LATCH type end connector.

Consult a Joy Engineer

or your nearest Joy office for further information on MINES package Derrick String-a-lite assemblies.

SALES AND SERVICE TO THE OIL FIELDS BY

JOY MANUFACTURING COMPANY

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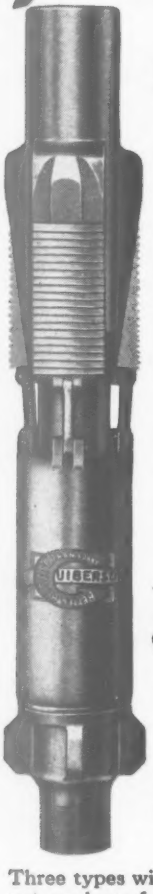
Safeguard TUBING

with Guiberson TUBING CATCHER

Stops the parted tubing before it falls 3 inches, without damage to casing walls. Releases easily and quickly and has large fluid and gas bypass area. Hangs free until tubing drops. Large area slips grip the casing wall firmly without distorting casing.



Reg. U. S. Pat. Off.

Type "E" Tubing Catcher

Type "B" Tubing Catcher

Three types with or without anchors for all sizes and weights of casing: Made in Type "E" with 3 slips for wells to 11,000 feet, Type "B" with 3 slips for wells to 7,200 feet, and Type "F" with 6 slips for extremely deep wells.

For complete data see the Composite Catalog, page 1528-32 or write to

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Guiberson U.S.A.

Established 1919

THE GUIBERSON CORPORATION

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BRANCH OFFICES: Oklahoma City and Tulsa, Okla.; Alice, Houston, Kilgore, Longview, Odessa, and Wichita Falls, Tex.; Lafayette, La.; Wichita, Kan.; Newark, Ohio.

Becomes consultant

W. T. Mendell, formerly area exploitation engineer for Shell Oil Company, Incorporated, has resigned this position to become a consulting petroleum geologist and engineer with offices in the Second National Bank Building, Houston. He is a graduate of Stanford University and the Royal School of Mines of the Imperial College in London. During his thirteen years with Shell he has had varied experience in oil and gas production problems in Roumania, California, Venezuela and Texas. With this background he will specialize in reserve studies, evaluations, and various oil and gas development problems.

W. T. Mendell

Lion opens district land office in Corpus Christi

Lion Oil Company announced today that it is opening a new district land and geological office in Corpus Christi, Texas. C. L. McArthur, Jr., who is at the present time district landman at the company's Abilene, Texas, office, will be in charge of the Corpus Christi office as district landman there. Louis Weltman has been transferred from the Jackson, Mississippi, office to assume the duties of district geologist in the office at Corpus Christi.

T. M. Martin, president, said "Lion Oil Company has been interested in the possibilities for the development of new reserves in this area for a number of years. Lion Oil discovered the McNeil Field in Live Oak county, Texas, in 1934. It also discovered the McFaddin gas field of Victoria county in 1930. Additional producing leases owned by the company in this area lie in the Sullivan City field of Starr and Hidalgo counties and in the Placedo field of Victoria county. Lion Oil has opened the Corpus Christi office planning an active exploratory campaign with particular emphasis at the start on the lower Gulf Coast adjacent to Corpus Christi.

Craig leads Continental's offshore drilling operations

Appointment of James G. Craig as superintendent in charge of Continental Oil Company's offshore drilling developments, to supervise operations off the coasts of Louisiana, Texas, and California, was announced by W. C. MacMillan, vice president in charge of production and drilling.

Continental Oil Company is now engaged with other oil companies in seismic explorations off the coasts of Texas, Louisiana and California, preliminary to drilling into the sea floor. Preparatory to the ocean drilling to follow, geophysical fleets are now at work in the Gulf of Mexico and off the California coast charting sub-sea structures. "Shoran," war-born device stemming from radar, is being used for the marine surveys.

Continental, Atlantic Refining Company, Cities Service Company and Tidewater Associated Oil Company, have expended $1,703,000 for leases in the Gulf of Mexico where the group now holds appfoximately 347,000 acres. Continental also is engaged with other firms in a partnership project doing sub-sea charting off the coast of California.

Craig will supervise Continental's marine drilling operations which are due to follow the seismic findings.

Born in Los Angeles, Craig entered the oil business as a youth and worked for several companies as derrickman and driller before joining Continental in 1932. He served Continental in various drilling assignments in the California fields and as region drilling superintendent before resigning a year ago to join another oil company.

On Latin American trip

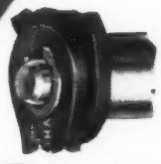
K. F. Forsyth, manager of California and export sales for Emsco Derrick and Equipment Company, Los Angeles, and Julio Zumeta, executive manager of exports for The Continental Supply Company, Inc., recently left for an extended field trip through the Latin American oil fields. Their first ports of call will be Venezuela, Colombia, and Mexico.

Julio Zumeta

R. E. Forsyth

During the past few months Emsco has sold considerable drilling equipment in South America and Mexico. The purpose of their visit is to study Latin American oil field operations and to determine the drilling and production equipment requirements in these areas. Continental Supply of New York is the exclusive distributor for Emsco-D-B drilling and production equipment.

NEW Whitney SNAP-RING CONSTRUCTION



Means Secure Fastening

- Can't Vibrate Loose
- Easy To Put On, Take Off

PLUS Offset Links for Rapid Adjustments

Here's the latest design advance in oil field chains . . . the *new Whitney Snap-Ring* construction. This *snap-ring* design eliminates cotter pins which often shake loose or break off. It means that you get secure fastening because the *snap-rings are tight and stay tight on the pins.* They won't vibrate loose or work off. They are easy to install, easy to remove without special tools. Add to this new construction, the *Whitney offset links*...which makes field adjustments easy by simply removing a link . . . and you have the most outstanding oil field chain for long-lived oil field service.

Investigate the new Whitney Oil Field Assembly Chain with the *snap-ring* construction, today.

Whitney CHAIN & MFG. CO.

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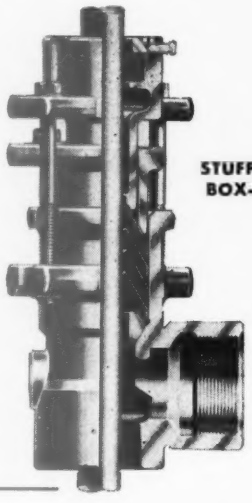
217 Hamilton Street, Hartford 2, Conn. Oil Country Warehouses located in Dallas and Los Angeles

FULLY PATENTED



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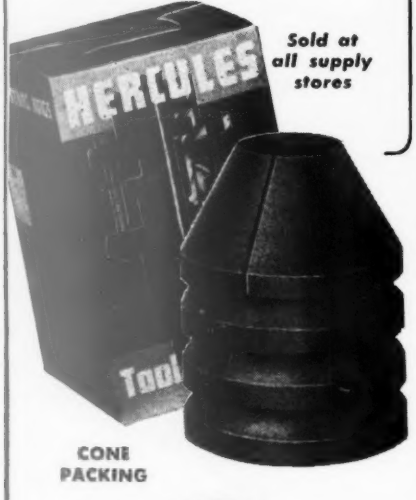

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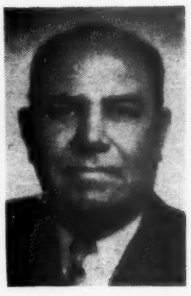
Set up export firm

Just announced is the organization of a new firm of export representatives, Champion and Smith, Inc., that brings



Frank Champion

R. E. Smith

R. B. Block

together two of the most colorful figures in the petroleum industry in a joint enterprise that will reach into every corner of the world. Offices are already set up in New York, New York; Los Angeles, California; Houston, Texas, and Caracas, Venezuela. Principals in the new concern are Frank Champion, president, and Roland E. Smith, secretary-treasurer, both former presidents of Nomads. Champion is a charter member of both the Los Angeles and Houston chapters, and was the second president in the latter. Smith was president of the Los Angeles chapter in 1944. The new firm will represent such west coast manufacturers as Abegg and Reinhold Company; B and W Inc.; Fullerton Manufacturing Company, and Globe Oil Tools Company, as well as two Texas organizations—Rufnek Products Company and Wilson Supply Company of Houston, Texas.

Frank Champion was for a time vice president and general manager of the oil tool division of Byron-Jackson Company, but has been in Texas for the past five years, where he is president of his own institution, Champion Oil and Gas Company. He is a graduate engineer from University of California at Berkeley.

Roland E. Smith was a civil engineering major at University of Minnesota. For the past five years he has operated with notable success as an independent export representative. He was for some years sales manager of Grant Oil Tools and before that was in the export division of Byron-Jackson Company.

South American representative of Champion & Smith is R. B. "Bob" Block, former drilling superintendent of the International Petroleum Company in Peru. He has experience also in Ecuador, Colombia and other Latin-American countries.

Headquarters of the Champion & Smith organization will be in the Oviatt Building, 617 South Olive Street, Los Angeles 14, California. The New York office is in the Eastern Airlines Building, Rockefeller Plaza, New York, New York, and the Houston address is Neils Esperson Building, Houston, Texas.

Eastman to Europe

H. John Eastman, president of the Eastman Oil Well Survey Company, left October 4 via the American Airlines Constellation on a trip that will include England, Holland, Belgium, France, Germany and Luxembourg. The purpose of this trip is to re-establish business associations disrupted by the war, and to get first hand information on the international petroleum situation in these areas where Eastman services and equipment have been extensively used in prewar years. He will return November 4 on the Queen Elizabeth.

Hoylman joins Fairchild firm

Fairchild Aerial Surveys, Inc., has announced that H. Wayne Hoylman has joined the staff of its Airborne Magnetometer division as chief geophysicist.

W. Wayne Hoylman

Hoylman was associated with Gulf Research and Development Corporation for 18 years, as a geological interpreter. He spent the last 14 years studying terrestrial magnetics and their application to petroleum geology. He has been closely associated with Gulf's airborne magnetometer operation since its inception, and for the last two years supervised a Gulf airborne magnetometer field party. This group, under Hoylman's direction, completed the magnetic survey of more than 100,000 sq miles in the United States and Canada.

Hoylman attended the University of California and the University of Pittsburgh, receiving A.B. and B.S. degrees from the latter.

He brings to Fairchild broad experience in magnetic exploration and interpretation. With him as a member of the staff, Fairchild now offers complete exploration and interpretation facilities. Hoylman's address is Fairchild Aerial Surveys, Inc., Airborne Magnetometer Division, 224 East 11th Street, Los Angeles 15, California.

FLYING MUD ENGINEERS

make remote water locations only a few minutes away!

The Magcobar "Mud Hen" is a familiar sight on the drill-barge circuit. Piloted by an experienced mud engineer, this amphibious airplane has proved extremely practical for extending Magcobar field service to remote water jobs. Inaugurated more than a year ago to provide the final measure of prompt, dependable service to the numerous drill-barges on the Louisiana coast, a second plane has since been added to expand this service.

Look to MAGCOBAR for improved mud products and service!

Magcobar

Complete

DRILLING MUD SERVICE

MAGNET COVE BARIUM CORPORATION

MALVERN, ARKANSAS **HOUSTON, TEXAS**

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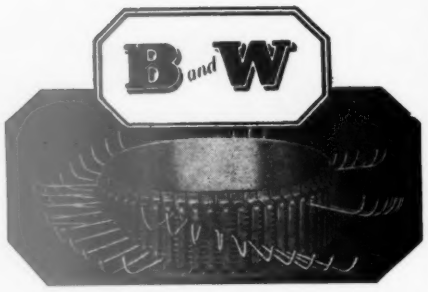
MAGCOBAR • MAGCOGEL • HIGH YIELD DRILLING MUD • XACT CLAY • MAGCO-PIBER • MAG-CO-MICA • TANNATHIN • JEL-OIL MUD • JEL-OIL "E" • SALT GEL NOHEEV • SEAL FLAKES • MY-LO JEL • CHEMICALS



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B & W Wall Cleaning Guides give you 100% fill on the first cementing.

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Well Completion Specialists

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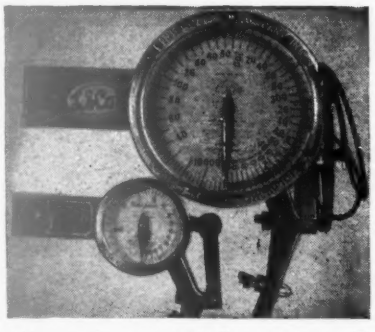
LINE SCALES



(Above) Super 500,000-lb. capacity, 14" dial. (Below) Packer Special, Capacity 40,000 lbs., 6" dial. 18 other models for every drilling, well servicing, or work-over need.

20 MODELS to choose from

With a LINE SCALE you know the pull on the line, and the weight on the bit in pounds. Repeated tests prove the accuracy and dependability of LINE SCALE readings under all working conditions . . . even in areas of rapid temperature changes.

LINE SCALE CO., Inc.

Box 4243 **Oklahoma City** Phone 6-1765

Gulf Coast Representative: Hiram Wheeler
Box 8043, Houston 4, Texas—J2-1107
Box 8043, Houston 4, Texas—J8-1107

Students are taught drilling mud control in evening classes

Classes in "Drilling Mud Control" were resumed on September 13 at John Dewey School, Long Beach, and were to commence September 27 at Bakersfield in their evening high school.

These classes are sponsored by the American Association of Oil Well Drilling Contractors and are designed to benefit the men actually working in the drilling of oil wells. Students are taught how to determine the weight, viscosity and other characteristics of the drilling fluid, and how to apply the remedies which may be required to properly condition the fluid. Such knowledge should not only benefit the student, enabling him to better perform his particular job, but should likewise benefit the employer. Realizing this, most employers look with favor on graduates of Mud Schools.

Buy Witt Gauge line

James P. Marsh Corporation, Skokie, Illinois, has announced the acquisition of the Witt Gauge Division of National Pressure Cooker Company, Eau Claire, Wisconsin, effective September 30th.

The purchase of the Witt line of gauges, which includes oxygen and welding gauges, is logical because it will further broaden the large line of Marsh pressure, compound and vacuum gauges and is in keeping with the expansion program that the Marsh Corporation recently inaugurated.

The identity of the Witt line will be preserved, but Witt gauges including the oxygen and welding gauges, will be produced in the Marsh plant by the "Witt Gauge Division" of James P. Marsh Corporation.

Manufacturers of precision instruments since 1865, the Marsh organization is in an excellent position today to carry out this broadened program as a result of having recently completed a new, ultra modern plant in Chicago's nearby suburb of Skokie, Illinois. The Marsh management describes the new home as the fulfillment of a manufacturing ambition which started many years ago.

IDA offers prize

The Industrial Diamond Association of America, Inc., offers a first prize of $100 and a second prize of $50 to oil engineers and other personnel for the best letter of suggestions for "Production and Economy Through Industrial Diamonds."

It is hoped that journals of the engineering societies and other trade publications will publicize the effort, publish the best and second-best letters, and so stimulate questions from industry. Answers would be prepared either by the named contestants or by the Association.

The letter is not restricted as to content, style or length, in order to give full freedom of expression to the writer. The only requirement is that the ideas of the writer shall be clear to all who read them.

Judges will be the Toolmakers and Research Committees of IDA and prominent industrial engineers.

Any party interested is invited to notify: Athos D. Leveridge, executive manager, IDA, 501 Lexington Avenue, New York 17. The applicant will receive further information and a form to return with his competing letter.

Check paraffin WITH SIW TOOLS

NEW! IMPROVED

SIW Paraffin Scraper type M-25 keeps wells from choking down with paraffin, and eliminates the work of pulling and running the pump. These scrapers are field tested, and can be field-installed on new or used rods with special tools provided by the Sunshine Iron Works. Where wax is a real problem, the SIW Paraffin Scraper has proven its worth. Long, tapered wings permit each scraper to be easily run into the tube, and to be used with a rod stripper.

We manufacture many other paraffin control tools for flowing wells, pumping wells, flow lines, and well dischargers. Write us for latest bulletins!

Sunshine Iron Works

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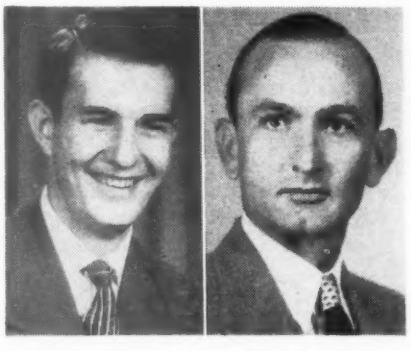
WECO adds to staff

Roy Shields, former WECO special representative, has been promoted to WECO sales representative and J. C. McCelvey and Bill Chilcutt added to the WECO sales organization. G. R. Winder, vice-president and sales manager, announced.

Roy Shields

In his new assignment, Shields will cover Southeast Louisiana and Mississippi and will headquarter in Baton Rouge, Louisiana.

McCelvey, former assistant foreman in the plant, will assume the duties of special service representative,



Bill Chilcutt J. C. McCelvey

formerly held by Shields. McCelvey is an "old-timer" there, having been employed in the shop for more than 10 years.

Chilcutt, a former Bovaird Supply Company store salesman, joins the WECO sales organization as a junior salesman under a new training program. Under this program, all junior salesmen, will begin with intensified shop, warehouse and office familiarization training.

Chilcutt, the first junior salesman to enter into the program has completed his indoctrination period and is now stationed in Oklahoma City, working as junior salesman under A. S. Bright, sales representative for Oklahoma and Kansas.

Schlittler leaves Falcon

H. F. Schlittler, formerly vice-president of Falcon Products, Inc., left the organization effective September 1. Falcon Products policies and field distribution of its slush pump liners, rods, pistons, and other components will remain the same.

Heading up the Falcon management are A. R. Loud, president; L. A. Theisen and W. G. Wellington, vice presidents; T. A. Needham, secretary and treasurer.

An important new book for oil geologists and engineers interested in the oil possibilities of the continental shelves.

SUBMARINE GEOLOGY

By Francis P. Shepard

The increasing importance of oil deposits on the continental shelves makes this new book a "must". The first full and authoritative volume on the floor of the ocean, waves and currents, shorelines, coral reefs, etc. Fully illustrated with photographs and charts.

338 pages—$6.00

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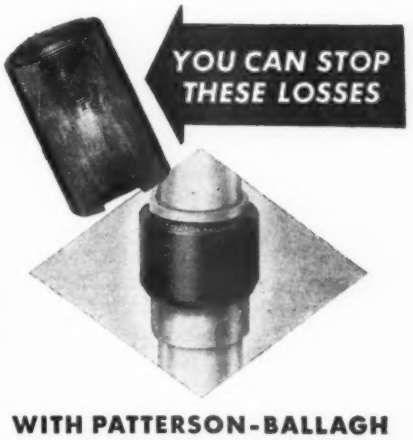

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Prevent tubing collar wear against casing to get more profit from pumping. These Plastic Protectors are oil-proof and wear-resistant—securely bonded at the factory to standard collars in all sizes. They will make your collars and casing wear longer. Check Composite Catalog for details and end your tubing troubles today.

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PLASTIC TUBING PROTECTOR

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Schlumberger employes reject CIO union

In an election held September 17 under the supervision of the National Labor Relations Board, over 77 per cent of the employees of the Gulf Coast division of Schlumberger Well Surveying Corporation voted against affiliation with the CIO Oil Workers Union, according to an announcement by Rover Henquet, vice president and general manager of the Schlumberger Company.

The Gulf Coast division of Schlumberger includes the headquarters and main plant at Houston, and branches at Beaumont, Liberty and Wharton.

The outcome of this labor election, the first to be called among the oil industry service organizations, is of considerable interest to the entire petroleum industry due to the fact that Schlumberger provides a number of highly technical services required in oil well drilling, and the control of these services by organized labor could disrupt drilling on the Gulf Coast in event of a strike.

J. W. Anderson promoted

Announcement is made of the appointment of James W. Anderson as assistant general sales manager of Whitney Chain and Manufacturing Company, Division of Whitney-Hanson Industries, Inc., Hartford, Connecticut. The announcement was made by W. H. Whitney, chairman of the board of directors, and was effective September 1.

James W. Anderson

Anderson will continue to make his headquarters in Dallas, Texas, where he has been stationed for the last 15 years. He moved to Dallas in 1934 to establish an oil country sales organization for his company, of which he has been in complete charge since, appointing all salesmen and arranging distributor outlets. These duties have taken him into the active oil areas of the United States and South America, which, together with attendance at all major conventions, gives him a wide acquaintance.

He is a member of the Dallas chapter of Nomads, but is able to attend almost as many meetings of other chapters due to his nomadic tendencies in the interest of his company.

Anderson's new promotion comes as deserved recognition of the steadily increased sales of Whitney products to the oil industry.

H. J. Litsey dies

Henry J. Litsey, general superintendent of the Ambridge, Pennsylvania, plant, Spang Chalfant Division of The National Supply Company, died September 16 at the age of 57. Mr. Litsey, whose home was in Edgeworth, Pennsylvania, had been employed at the plant for 31 years and had been general superintendent since 1943. He attended Horrodsburg Academy and the University of Kentucky.

Mud Products add new sales engineers

Mud Products, Inc., of Tulsa, Oklahoma, distributors of Mud equipment, drilling muds and chemicals have added two new sales engineers to cover the Oklahoma and West Texas areas, according to E. R. "Dick" Albert, the firm's general manager.

Stewart W. Wortley, former assistant superintendent with Otis Pressure Control Co. and safety engineer for Traders and General Casualty Company in West Texas, will be the sales and engineering representative in the West Texas area with headquarters in Midland.

Happy H. Miles will be the sales and engineering representive in the Oklahoma territory with headquarters at Mud Products main office in Tulsa. Miles was formerly associated with Anchor Petroleum Company and Southern Gas Company in the LP Gas equipment sales division.

Both men are Tulsa residents and graduates of the University of Tulsa.

New marine salesman

George H. Kinsman has been made marine salesman for the Houston Division of Cummins Sales & Service, Inc., exclusive distributors of Cummins Diesel Engines. He will specialize in power for off-shore drilling and marine practice.

George H. Kinsman

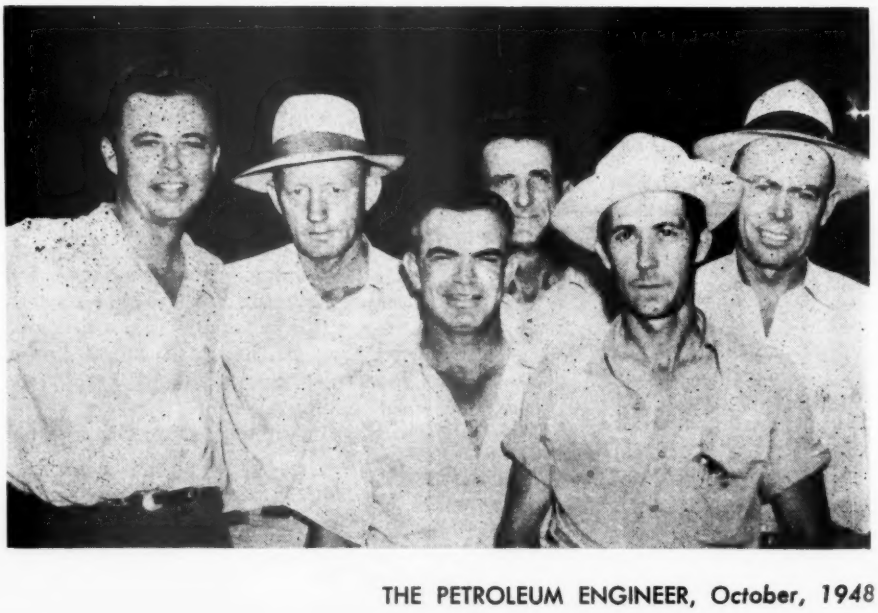
Kinsman received his education at Massachusetts Nautical School and Tufts College, where he received a degree in mechanical engineering. His valuable experience in the application of diesel power and engineering problems is augmented by four years in the Navy as engineering officer with the rank of Lieutenant Commander.

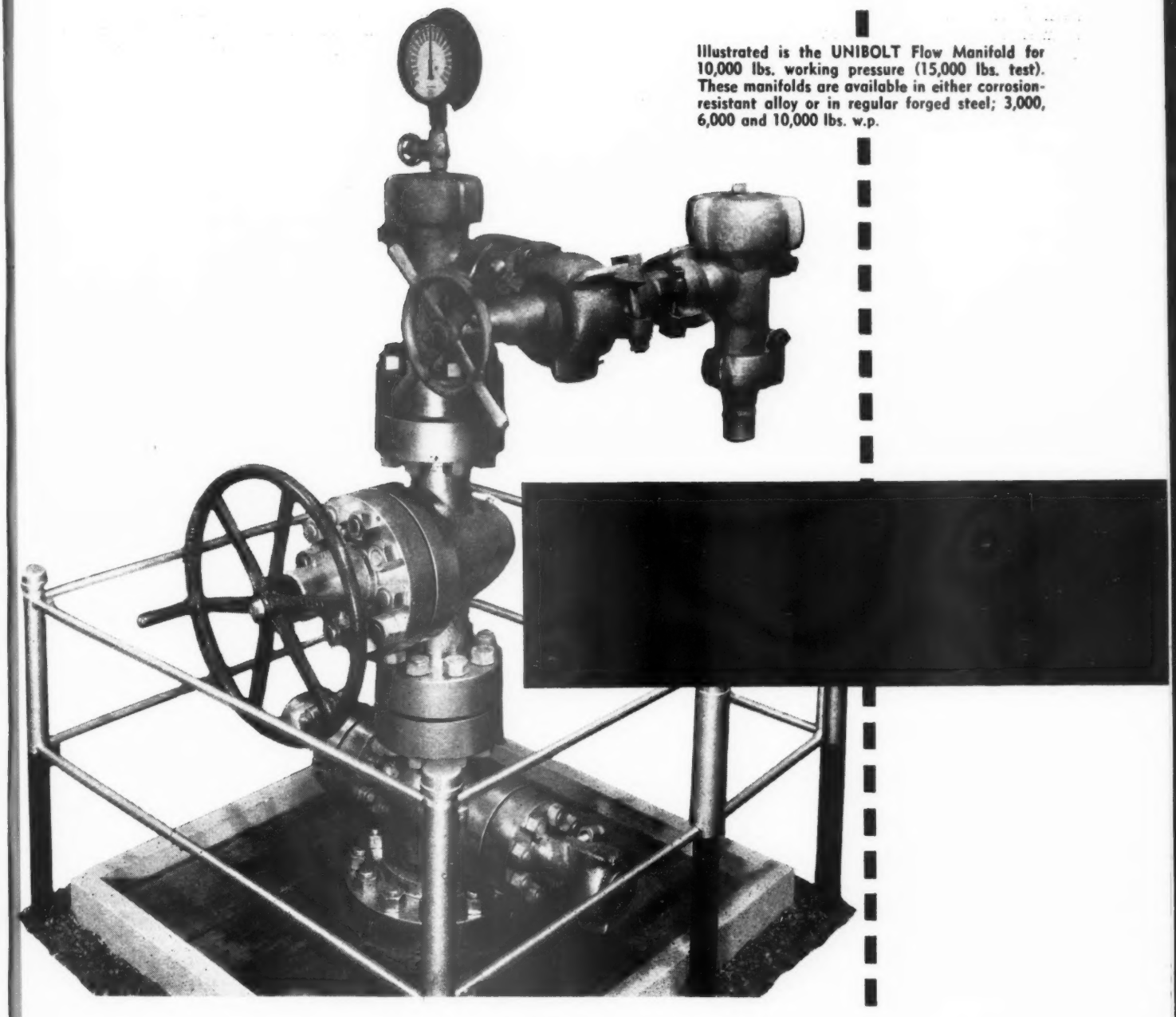
Prior to the war and just before coming with Cummins Sales & Service, Inc., he worked for the Fairbanks Morse Company.

McDonough joins Iverson

Ed Robertson, sales manager of Iverson Supply Company, Tulsa, announces the addition of J. B. McDonough to the company's sales staff. He will work out of the Houston office, at 909 Standard Building. Prior to his connection with Iverson, McDonough was associated with United Supply Company in the Gulf Coast area.

Grady Vaughn's first drilling crew: Left to right: W. L. (Bill) Carwile, district sales manager, Dallas, for Eastman Oil Well Survey Company; N. C. McCain, toolpusher, Spartan, Magnolia; Bill Manning, representative, H. C. Smith Oil Tool Company, Haynesville; R. C. Bearden, welding contractor, Magnolia, Arkansas; Lee Kaiser, drilling superintendent, Spartan; and "Keg" Oliver, toolpusher for Zack Brooks, Haynesville, Louisiana. Taken at Spartan and Stanolind's Bodcaw No. 1 during a field test of the new Turbodrill.





Illustrated is the UNIBOLT Flow Manifold for 10,000 lbs. working pressure (15,000 lbs. test). These manifolds are available in either corrosion-resistant alloy or in regular forged steel; 3,000, 6,000 and 10,000 lbs. w.p.

UNIBOLT *Flow Manifold*

The UNIBOLT Flow Manifold was designed to eliminate much of the bulk and weight of conventional flanged Christmas trees, yet, because of the patented UNIBOLT design, this manifold actually provides a higher factor of safety than the heavier flanged manifolds.

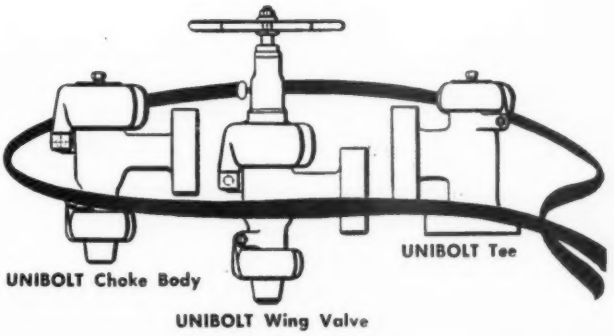
The use of a UNIBOLT Adjustable Wing Valve instead of an ordinary gate or plug valve on the wing is an innovation that has met with the approval of numerous operators, due to the fact that it provides a dependable and easy operable wing valve, requires no grease to effect a seal, costs substantially less, and can be completely overhauled without removal from the well.

Another important advantage of the UNIBOLT Flow Manifold is its complete interchangeability. All connections in the manifold are standard forged steel UNIBOLT Couplings, and any unit in the assembly, or part thereof, may be easily and quickly replaced in the field without removing the manifold from the well.

See your Composite Catalog for complete details, or write direct for literature.

THORNHILL-CRAVER COMPANY

HOUSTON, TEXAS



THREE DISTINCTIVE UNIBOLT FITTINGS Tied Together In A Strong, Light-Weight, Pre-tested Flow Manifold.

Production head

Basil P. Kantzer, a graduate in petroleum engineering from Stanford University, and formerly chief production engineer for Union Oil Company of California, was recently appointed manager of field operations for California,

J. E. Sherborne

B. P. Kantzer

succeeding W. J. "Swede" Larson, resigned. He is chairman of the API central committee on district activities, and past chairman of the engineering board of California Conservation Committee.

Simultaneously announced is the appointment of John E. Sherborne to the position of chief production engineer, succeeding Basil Kantzer. Sherborne is a Cal Tech graduate and is considered one of the West's leading authorities on then interpretation of core analyses.

Office moved

The Kansas district office of Oil Well Supply Company has been moved from Great Bend, Kansas, to Wichita, M. Barkhurst, manager of this U. S. Steel subsidiary's Mid-Continent division, announces. F. G. Irick, district representative, will remain at Great Bend in charge of the sales office. T. E. Dawson is manager of the Kansas district.

In personnel changes also announced by "Oilwell's" Mid-Continent division manager, Royal F. Shaner was promoted to district engineer for the Oklahoma district, with headquarters at Oklahoma City, and W. O. Williams was appointed manager of the Madill, Oklahoma, store, succeeding L. G. Hutchison, who was transferred to Healdton as field representative.

Shaner, a native of Topeka, Kansas, has been assistant Oklahoma district engineer since May, 1947. He was graduated from Kansas State College with a degree in mechanical engineering and was employed by "Oilwell" in 1936.

Williams has been connected with the Madill store since joining Oil Well Supply Company in 1943. He attended the University of Oklahoma. Hutchison was named manager of the Madill store in May, 1947. Prior to that time he was a storeman in the Oklahoma City store.

Kobe promotes Elner

Ray Elner, district manager for Kobe, Inc., in the Los Angeles Basin for the last three years, has been promoted to assistant to Russell G. Ralph, Mid-Continent division manager. He will have charge of company contacts in the Fort Worth and Dallas areas and will also handle such other sales and technical operations in the Mid - Continent as may be assigned by the division manager.

Ray Elner

Elner began his production experience with the Standard Oil Company of New Jersey in Venezuela. He first joined Kobe, Inc. in 1934, working out of the California office. During the war, he served in the AAF aircraft modification center at Belfast, Ireland, returning to Kobe, Inc. in 1944.

75th anniversary

Seventy-five years under one management—that is the anniversary the S. G. Taylor Chain Company, Hammond, Indiana, is proudly celebrating this year.

The beginning of the company dates back to 1873. S. G. Taylor, a man of courage, vision and high integrity first began manufacturing chain in Chicago. As the "Industrial Revolution" evolved, Taylor's progressive spirit spurred the company to the development of better chains to meet the growing needs of industry. In 1911 the site of the plant was moved to Hammond, Indiana, where it has been operating ever since.

S. G. Taylor, Jr., joined the organization in 1888 and succeeded the founder in 1901. He is active in the affairs of the company today. His son. E. W. Taylor, now heads the company as president and general manager.

Taylor chain was one of the first to develop alloy steel chain for industrial use.

Radiotelephone aids frozen core pickup

"Operator, this is Core Laboratories, Inc., 6-5946, Oklahoma City, calling ZF-45833."

"Hello, Car No. 9. If you are headed to our lab turn back on Highway 81 and go to White Company's Jones No. 4 near Duncan. Pick up frozen cores. Call in before you leave that location. Black Company's No. 12 in the Velma field is coming out of the hole and may want to use spare freeze box you are carrying."

"Roger!"

If Alex Bell could have prophesied that conversation he'd probably have introduced his gadget to the world with the statement, "Mr. Watson, come here —and bring those frozen cores with you."

Early in 1946, Core Laboratories, Inc., introduced the method of freezing cores in order to preserve their fluid content while the samples were in transit to a permanent lab for analysis. This method of preserving cores requires the servicing of many freeze boxes spotted throughout an active drilling area.

To facilitate pick-up and delivery Core Lab's field cars, stationed at the company's Oklahoma City base point, are now equipped with mobile long-range radiotelephone equipment. Drivers of the cars are able to contact their home office in Oklahoma City immediately before leaving a remote location. Efficiency of the units and personnel has been increased more than 35 per cent. it is stated.

W. H. Davison, president of Core Lab, has announced that as soon as details of the initial operation have been checked, other automobiles operating in active drilling areas where transmitting towers are available, will be equipped with mobile telephone systems.

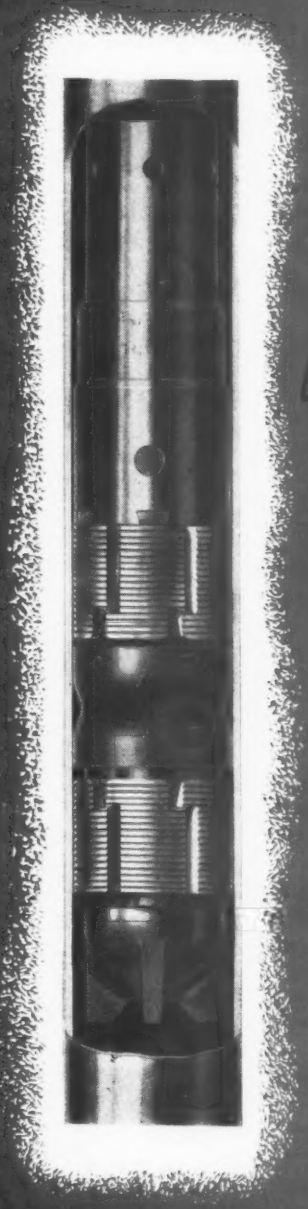
Enlarge staff

Recent additions to the field engineering staff of Technical Oil Tool Corporation, Ltd., include Phillip Fouché, John Carr, and John Brown. Fouché with headquarters at Hobbs, New Mexico, is

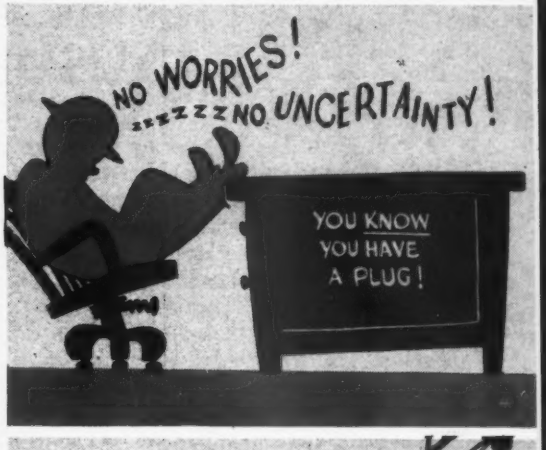
Fouché Carr Brown

covering the area that includes Liberal, Kansas; Frankel City, Pampa, and Sundown, Texas. John Carr serves Carthage, Longview, Winnsboro, and Kilgore, Texas, working out of Kilgore. The Southern Louisiana territory is in charge of John Brown who maintains his headquarters at Lafayette.

CHOOSE A LANE-WELLS DRILLABLE BRIDGING PLUG



Ask any Representative Details on Drillable Lane-Wells for Complete Setting a Bridging Plug



GET IT – SET IT – FORGET IT – OR DRILL IT!

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LOS ANGELES • HOUSTON • OKLAHOMA CITY

24-HOUR SERVICE — General Offices, Export Offices and Plant — 45 BRANCHES

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Australasia*

▸ **General.** The large scale program of petroleum exploration in Australia and the Territories of Papua and New Guinea is being carried out with increasing vigor. The larger companies involved in this prospecting work represent American, English, and Australian interests; their field staffs are under the leadership of geologists, geophysicists, and technologists widely experienced in foreign fields and the equipment being used includes the most modern instruments and plant available in the United States.

The Bureau of Mineral Resources, Geology and Geophysics, of the Commonwealth Government Department of Supply and Development, has a wide program of regional geological and geophysical exploration supported by scout drilling, for which modern equipment from overseas has been ordered.

▸ **Papua and New Guinea.** The Australasian Petroleum Company Pty. Ltd. has carried out further geological and geophysical surveys over extensive areas. At the end of March 1948, the company completed its Kariava No. 1 bore at a depth of 12,621 feet, without encountering any indications of petroleum. This is the deepest hole yet drilled in Australasia. New drilling sites have been constructed at *Hohoro*, near the mouth of the Vailada River; at *Upoia*, on the Vailala River about 25 miles south of Kariava, and at *Oroi*, near the coast about 50 miles northwest of Port Moresby. Two rigs, rated for 5000 ft, have been imported by the company and will be used at Upoia and Oroi. Shipping and supply difficulties have caused lengthy delays in the delivery of this equipment, but the erection of a plant at the new sites is now near completion. The Kariava rig is being dismantled and transferred to Hohoro where the company proposes drilling its second deep test. In order to speed up its drilling program, the company is importing two additional drilling outfits, one rated at 10,000 ft and the other at 5000 ft.

▸ **Queensland.** Shell (Queensland) Development Pty. Ltd., has continued its geological and geophysical surveys over areas in central and western Queensland. About the middle of January 1948, the company commenced scout-drilling operations in the Rolleston area, 262 miles west of Rockhampton, and since then has computed 9 holes in the area. The company has announced tentative plans for a 10,000 ft test at Warrinilla, 105 miles north of Roma; two scout bores have already been drilled in the area, which had been previously covered by an aerial survey. Machinery for this deep test is now beginning to arrive in Australia.

The group of companies headed by Roma Blocks Oil Company N. L. have continued with the geological survey of areas in the Roma district. A geophysical survey of the area, conducted by parties from the Bureau of Mineral Resources, Geology and Geophysics, was commenced at the end of 1947.

▸ **New South Wales.** Oil-shale deposits at Newnes are being developed by National Oil Proprietary, Ltd., with financial assistance from the Commonwealth government.

▸ **Victoria.** At Lakes Entrance in Eastern Gippsland, Lakes Oil Ltd., is still attempting to obtain oil production by drilling horizontally and radially from a work chamber at the base of a central shaft, sunk to 1156 ft, into the oil-bearing glauconitic sandstone formation.

A geophysical survey, to be conducted by parties from the Bureau of Mineral Resources, Geology and Geophysics, is proposed for the Nelson-Portland area in western Victoria, where the Nelson bore (7305 ft) proved the existence of a deep section of Middle Miocene sediments.

▸ **South Australia.** The Frome-Broken Hill Company Pty. Ltd., assisted by a geophysical party from the Bureau of Mineral Resources, Geology and Geophysics, has completed surveys in the Lake Frome area and adjacent parts of New South Wales, where an intensive search has been made for natural gas. Test-drilling is expected to follow.

▸ **Western Australia.** The Freney Kimberley Oil Company (1932) N. L. suspended operations at its Nerrima bore, 150 miles east of Broome, early in 1942, at a depth of 4271 ft. Extensive delays in delivery of equipment caused by shipping and supply difficulties have hindered the resumption of drilling operations. The company is now actively engaged in preparing plant and equipment in readiness for the completion of the bore.

Geologists of the Australian Mining and Smelting Company Ltd., have carried out extensive reconnaissance surveys over the Fitzroy River area in the northern part of the State.

The Australian Motorists Petrol Company Ltd., in association with Richfield Oil Corporation of California, has been granted an Oil Prospecting License over an area in the Northwest Basin. Permits held by Caltex have been surrendered.

▸ **Northern Territory.** Extensive field work has been carried out by geologists of the Bonaparte Gulf Company Pty. Ltd. in the Bonaparte Gulf region, and surveys of the Burt Range Basin and the Bonaparte Gulf Basin have been completed. ★ ★ ★

*Information from W. J. F. Riordon, acting minister for supply and development.

BLEND COMMON SENSE WITH CONSERVATION METHODS

"PUTTING first things first" is an expression, and a principle of conduct so trite and so obviously correct that it bids fair to become merely a saying instead of supplying a strong motive power to direct our personal and community activities. A broad case in point is that of the feverish hunt for conservation methods to extend our crude supplies to meet the unforeseen and unprecedented postwar demands of our "peacetime" economy.

Plainly, real conservation of crude petroleum involves two phases: Avoidance of use of these products for purposes for which other sources of heat energy exist and may be used, and obtaining more ton-miles of transportation per gallon of petroleum fuels, or more unit increases of temperature per barrel of fuel consumed. This need for fuel efficiency is especially acute in the automotive divisions of the American scene. The automotive industry has shown conclusively recently how the (economy) efficiency of an engine may be boosted as much as 40 per cent, with up to 25 per cent being rather easily attainable, referring to revelations of Kettering and associates regarding the operation of a 12.5 to 1 compression ratio engine, using 100 octane fuels, which can be produced by the refining industry.

The great majority of petroleum refining technological leaders know, however, that the production immediately, by known refining processes, of the required quantity of these super fuels will waste large percentages of petroleum. Holaday has pointed out that raising the octane rating of motor gasolines supplied to the trade will cost approximately 1 per cent in total production for each octane number gained. There is no doubt, of course, that the refining industry, with the record of aviation fuel production from 1942 to 1946 behind it, can and will produce that kind of fuel, if and when necessary. But if we assume from published data that an increase of 20 octane numbers is necessary to meet the needs of the wondrously efficient Kettering 12.5:1 engine, then it can be assumed that the loss in round numbers of gasoline production will be 20 per cent of the present yield. This means a reduction of the yield to between 30 and 35 per cent of the crude processed, leaving a gap, per se, between demand and supply that could well wreck our national economy.

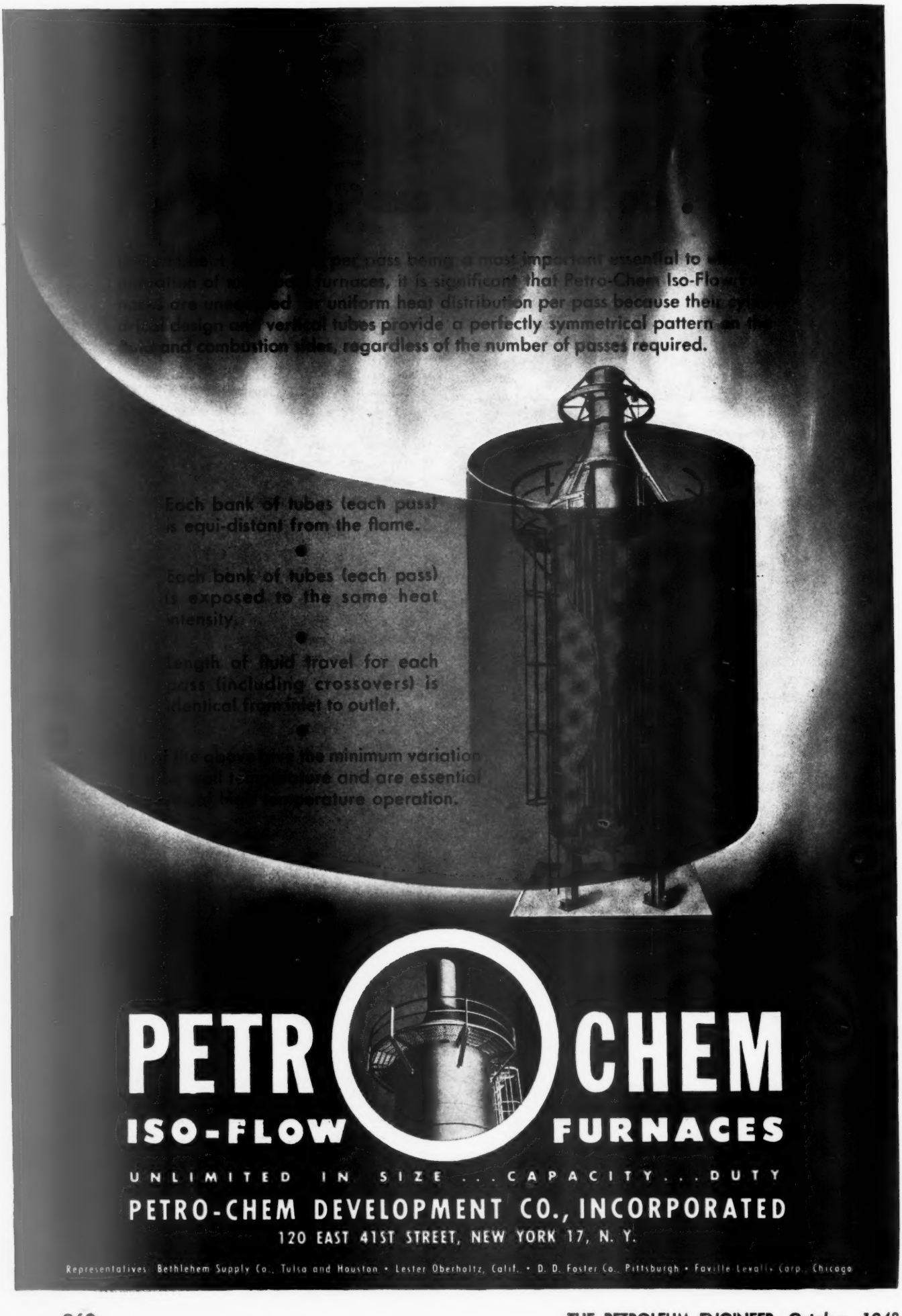
Since the huge majority of engines on the road now have no need for the ultra fuels of 100 octane number; since those of highest compression ratio need such fuels only a small fraction of their operating time, the most satisfactory answers to the dilemma for the present have been advanced most ably by Pigott, Colwell, Holaday and others, and preliminary steps are being taken to implement these suggestions in the most practical ways. Three suggestions have been made. One, to install a dual-carburetor arrangement, whereby a lower octane rating fuel is used to operate the engine under normal driving conditions, while under heavy load conditions a supplementary fuel of much higher rating is fed to the carburetor; two, what amounts to essentially the same thing, an auxiliary unit supplies automatically into the fuel intake a knock suppressing additive, such as a water-alcohol-TEL mixture, when heavy load is thrown on the engine, to eliminate knock; and three, the development of improved torque-converters, which for example give high road speeds with low engine speeds to eliminate knock by this means.

The other alternative, that of supplying high octane rating fuels to the automotive engine operator, appears to be the least desirable of all. Much of its operating time the present-day engine needs nothing higher than 50 octane number, or even lower, and doubling that value is waste for up to 85 or 90 per cent of the engine's operation. Supplying extra knock rating for the short periods of severe operating conditions appears to have the nod from our best qualified engineers and industry leaders. Whether this is accomplished by the use of a dual-carburetor and two separate fuels, or by the employment of a special injection device to supply anti-knock compounds to the regular fuel when needed becomes a matter of economics and of the relative ease of operation of the special equipment, with a strong bid in favor of the most foolproof of the several arrangements.

By such means, however the mechanical requirements may be met, the refining industry can supply the needed fuel qualities for any engine which may require a super-fuel; the refining industry will not be called upon to supply these highest rating fuels to consumers, 95 per cent of whom have no need for the high quality, and the total production of motor fuel can remain at the highest value attainable with present refining methods.

At the same time the automotive industry may continue to develop better and more efficient engines to its heart's content, feeling certain that the needed fuel can be obtained *where and when it is needed,* without burdening both industries with needless waste in costs and yields without any advantage accruing to either of the industries or to the common consumer of their products. It is high time some intelligent, common-sense action be taken by either or both industries to achieve these results in a practical way; it is heartening to note that at least one apparently practical effort is being made to solve the problem, this time by the method of supplying anti-knock mixtures when needed.

Arch L. Foster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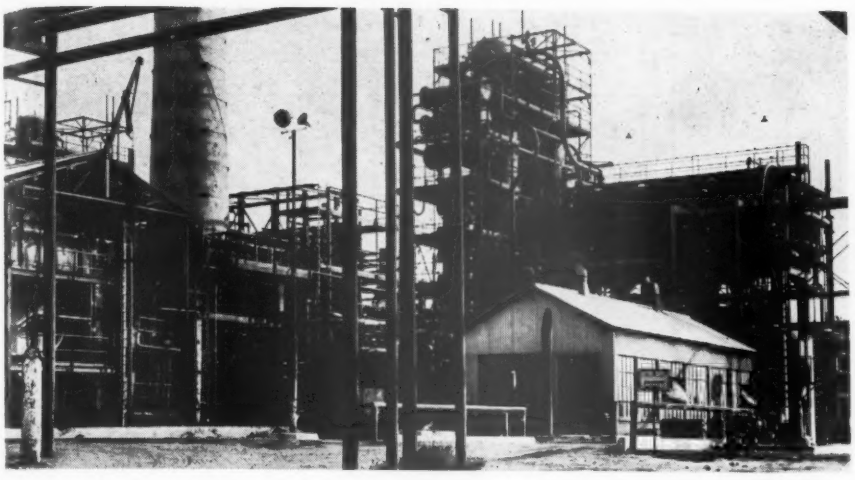

Phillips polyforming unit.

Self-Contained Naphtha Polyforming Correlation

By W. A. GOLDTRAP and E. L. JONES

Phillips Petroleum Company

Summary. *Self-contained naphtha polyforming differs from thermal reforming since the C_3's and C_4's made from naphtha are recycled with naphtha. Self-contained naphtha polyforming using a commercial recycle ratio of 1:1, mostly propane, produces more gasoline of a better octane number than does thermal reforming of naphthas at the same pressure and at the same severity of cracking. Gasoline yields from self-contained naphtha polyforming are substantially independent of pressure but the octane number improvements vary directly with pressure. Reducing the recycle of the C_3's and C_4's formed from the naphtha gives gasoline yields intermediate between self-contained naphtha polyforming and thermal reforming. Octane number improvements and the corresponding severities are greater for self-contained naphtha polyforming than for thermal reforming. The sensitivity (clear Research octane number minus clear ASTM octane number) of polyform gasoline is greater than that of gasoline from thermal reforming.*

PHILLIPS PETROLEUM COMPANY has operated commercial polyforming plants for more than a decade. Data secured from these plants plus pilot plant data from the literature[1] have been used in this correlation. The chief purpose of the correlation is to present a simple relationship between the gasoline yield and the octane number improvement obtained from self-contained polyforming of straight-run naphthas in order that the effect of changing feed stock or other conditions can be estimated. A second purpose is to compare the gasoline yield and octane number improvement obtainable from self-contained naphtha polyforming with those from the thermal reforming of straight-run naphthas, on the same basis. Such information could be used as the foundation for comparative economic studies in proposed refinery changes. Previous correlations,[1, 2] are more complicated and do not present a simple comparison with thermal reforming. A severity index similar to that used in previous correlations on polyforming and thermal reforming has been used.

Self-contained naphtha polyforming is defined as the thermal treatment of naphtha in a coil in the presence of recycled gases such as propane, propylene, butanes and butylenes, which are returned to the coil at high pressure after separation from gasoline and ethane and lighter. The recycled light hydrocarbons may be recovered by several methods, but in self-contained naphtha polyforming they originate only from the naphtha charged to the coil. Such recycle is mostly propane in a commercial coil with a recycle ratio of 1:1 on a liquid volume basis, and this correlation is substantially limited to this case.

The separation system may be operated in such a manner that part of the C_3's and C_4's are rejected from the system before recycling. The C_3's and C_4's withdrawn from the system may be used for alkylation or other purposes.

Description of polyforming. The light hydrocarbons charged with the naphtha combine with the decomposition products of the naphtha to form gasoline. In thermal reforming, coke formation limits the octane number improvement obtained by increasing the severity of treatment. In polyforming the reduction of partial pressure of the tar due to the gaseous dilution and the attendant lowering of the critical temperature and the dew point prevent the deposition of the tar and the consequent formation of coke. These conditions permit greater severity in polyforming than in thermal reforming. Accordingly more gasoline of a higher octane number is obtained in polyforming. Fig. 1 shows a simplified flowsheet of a typical polyforming operation. Naphtha is combined with the poly charge (liquefied recycle C_3's and C_4's from the separation system) and charged to the furnace coil. Pressures in such a coil range from 1000 psig to 2000 psig in commercial operation. The furnace effluent exchanges heat with the cold charge. The high pressure is then released through a pressure control valve to about 400 psig. A cooling oil may be used to reduce the temperature of the furnace effluent. This cooling oil is merely circulated and has no function other than arresting the reaction. In a fractionating system the products of polyforming are separated into gasoline, recycle C_3's and C_4's fuel oil or tar, and ethane and lighter.

Basis for correlation. The basis chosen for correlating the gasoline yields and octane number improvements in self-contained naphtha polyforming was the weight per cent of the naphtha charge converted to ethane and lighter, *hereinafter referred to as the severity factor*. Gasoline yields and octane number improvements obtained from the thermal reforming of naphthas were also correlated on this same basis for comparison.

Data used in the thermal reforming correlation include a large number of

EXCLUSIVE

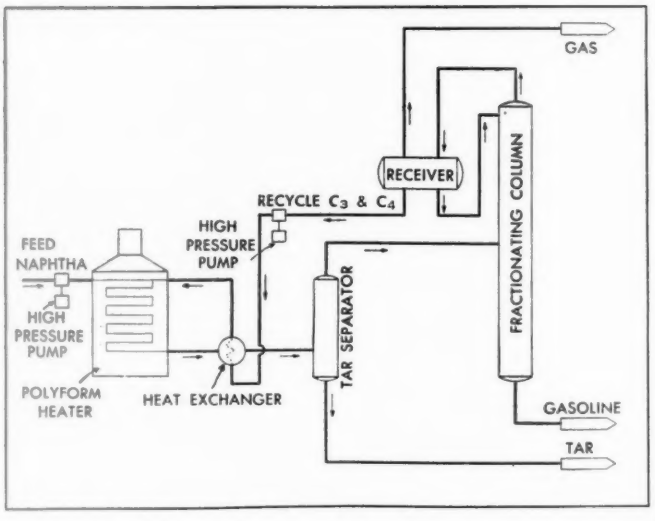

FIG. 1. Phillips polyforming process.

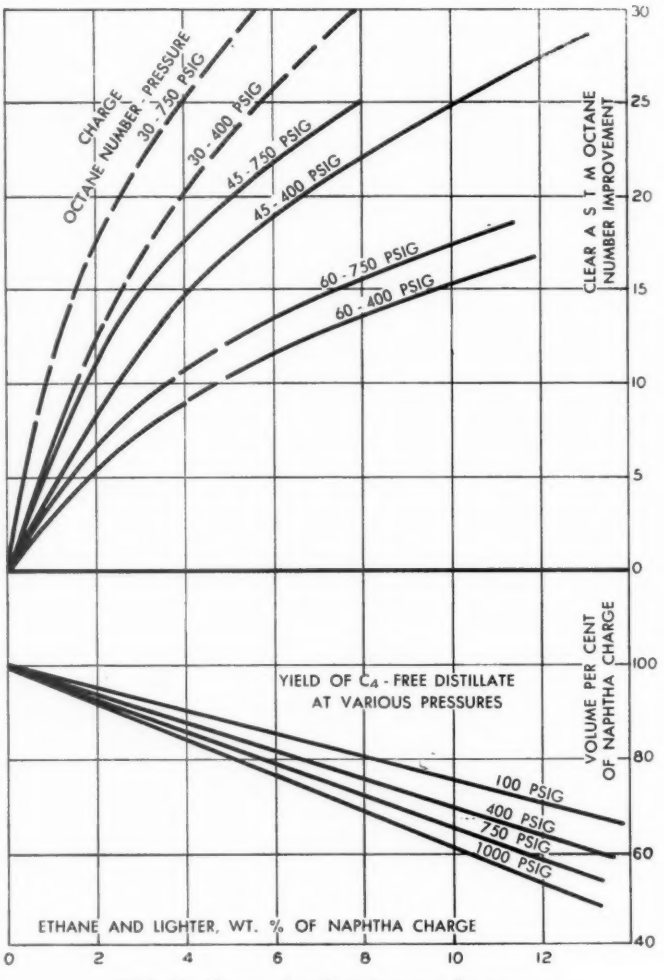
CHARGE OCTANE NUMBER - PRESSURE
30 - 750 PSIG
30 - 400 PSIG
45 - 750 PSIG
45 - 400 PSIG
60 - 750 PSIG
60 - 400 PSIG
CLEAR A S T M OCTANE NUMBER IMPROVEMENT
YIELD OF C4 - FREE DISTILLATE AT VARIOUS PRESSURES
100 PSIG
400 PSIG
750 PSIG
1000 PSIG
VOLUME PER CENT OF NAPHTHA CHARGE
ETHANE AND LIGHTER, WT. % OF NAPHTHA CHARGE

FIG. 2. Thermal reforming results on new correlation basis.

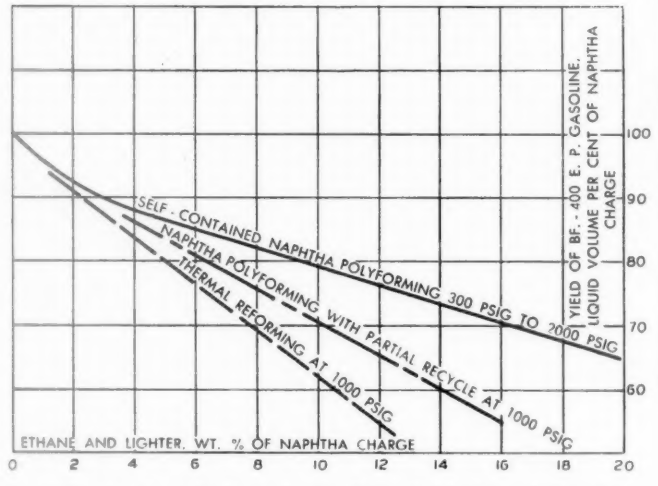
SELF - CONTAINED NAPHTHA POLYFORMING 300 PSIG TO 2000 PSIG
NAPHTHA POLYFORMING WITH PARTIAL RECYCLE AT 1000 PSIG
THERMAL REFORMING AT 1000 PSIG
YIELD OF BF. - 400 E. P. GASOLINE, LIQUID VOLUME PER CENT OF NAPHTHA CHARGE
ETHANE AND LIGHTER, WT. % OF NAPHTHA CHARGE

FIG. 3. Correlation of gasoline yields in polyforming and thermal reforming.

straight run naphthas from widely different sources. The yield of butane-free, 400°F. endpoint gasoline, in liquid volume per cent of naphtha charge, (hereinafter referred to as the gasoline yield) is essentially a straight line function of severity factor, depending on pressure. See Fig. 2.

By definition, self-contained naphtha polyforming consists of high pressure thermal treatment in which the propane, propylene, butanes and butylenes are recycled in the same coil as the naphtha. Since propane and propylene react in the coil and are not effluent products, one way of measuring the degree of reaction is by the ethane and lighter produced. Since the data discussed above showed that the yield of gasoline is a function of the yield of ethane and lighter products (severity factor), for thermal reforming, yields of gasoline from naphtha polyforming at the same pressure may be expected to correlate against severity factor, although the gasoline yields will be greater than those from thermal reforming by an amount equal to the gasoline formed from polymerization and alkylation of the recycled gases.

The thermal naphtha reforming correlation referred to above also shows that the amount of C_3's and C_4's made from the naphtha increases with the depth of reforming.

If it is assumed that the magnitude of cracking, polymerization, and alkylation of the recycled gases with the compounds formed from the naphtha also increases with depth of cracking, then the volumetric yields of debutanized gasoline from naphtha polyforming will fall on a line diverging from and above the line obtained when gasoline yields from thermal reforming are plotted against severity factor.

Similarly Fig. 2 shows that, up to 1000 psig, octane number improvement in thermal naphtha reforming is a function of pressure and charge octane number when plotted against depth of cracking measured as ethane and lighter in weight per cent of naphtha charge (severity factor).

Greater octane number improvements may be expected from self-contained naphtha polyforming than from thermal naphtha reforming because:

1. Higher octane numbers result from the increments of high-octane polymers and alkylates formed from recycled gases and the naphtha.

2. Greater severities of cracking are permissible. The greater severities of cracking are related to a larger severity factor, and therefore self-contained naphtha polyforming octane number improvements would be expected to show as points on the same rising curve as the octane number improvements from thermal reforming at the same pressure. Polyforming points will be at a higher severity factor than those for thermal reforming. Trial plots on the coordinates above revealed this to be true and that the thermal naphtha reforming correlation can be extended to polyforming.

Also it was found that naphtha polyforming with partial recycle produced yields of debutanized 400 EP gasoline.

which were greater than those from thermal reforming of naphtha at the same pressure and less than those from self-contained naphtha polyforming, the exact value being determined by the amount of recycle polyfeed.

Scope and accuracy of the correlation. Data may be classified as:

(a) Self-contained naphtha polyforming, and

(b) Naphtha polyforming with partial recycle.

Data in class (a) may be grouped again with respect to pressure as 2000 psig, 1500 psig, 1000 psig, and 500 psig and less. Only the data at 1500 psig and 1000 psig were sufficiently numerous to warrant smooth plotting, but all data follow the correlation basis previously outlined. The data for naphtha polyforming with partial recycle fall into the same pressure groupings as the data for self-contained naphtha polyforming.

The correlation permits ready comparison of self-contained naphtha polyforming and thermal naphtha reforming.

The correlation as developed satisfactorily predicts yields and octane numbers of pilot plant polyforming data in the literature[1] as well as data from commercial scale runs in which the volume ratio of recycle C_3 and C_4 hydrocarbons to naphtha feed approximated 1. In all, the correlation was tested against 46 charge stocks from at least 14 different crudes, including Middle East and South American crudes as well as those from the United States or about 200 polyforming runs, including commercial plant and pilot plant information.

The accuracy of the correlation is such that the gasoline yields can be estimated to ± 3 liquid volume per cent of naphtha charge. Octane number improvements can be predicted to ± 2.0 octane numbers.

The effect of pressure on the same naphtha increases the octane number improvement for the same yield. The effect of depth of reforming on the sensitivity (Research clear octane number minus A.S.T.M. clear octane number) of the finished gasoline is also shown to depend upon the "Characterization Factor" of the naphtha and the pressure. No limits of accuracy are defined for the sensitivity curves. Recycle ratios are not correlated here since recycle is essentially constant over a range of about 100 to 110 liquid volume per cent of naphtha charge. Where the recycle ratio is greater than this, operating costs and investment increase rapidly.

Relationship of gasoline yield to severity factor. The yield of butane-free 400 F endpoint gasoline in self-contained polyforming is a function of the severity factor and is substantially independent of the pressure. This relationship is shown in Fig. 3, which gives yields of gasoline from self-contained polyforming at pressures from 300 psig to 2000 psig. Table 1 includes examples of some data from which this figure was drawn. The polyforming operations on the Borger natural gasoline are unusual but serve to illustrate the universal nature of the correlation. Literature data also used in developing this figure include naphtha charges from diverse sources, their characterization factors ranging from 11.6 to 12.4. The ASTM boiling range of the naphthas was from 200 F to 400 F approximately. All of the naphthas had low sulphur contents, less than 0.15 weight per cent of total sulphur. Charge octane numbers varied from 7 to 71. Acid heats were less than 16 F. Aniline points varied from 154 F to 106 F. Gravity ranged from 81 to 46° API. The difference between the yields of debutanized, 400 EP gasoline obtained from self-contained naphtha polyforming and thermal reforming may be estimated from Fig. 3 for an operating pressure of 1000 psig. As the severity factor increases, the difference in yield becomes greater. This incremental yield from self-contained naphtha polyforming is probably due to the polymerization of the larger amounts of gases which are produced by the naphtha at the more severe operating conditions.

TABLE I. Self-contained naphtha polyforming operations in Phillips' refineries.

Run number	1		2		3		4		5		6	
Crude source	Borger		Borger		Borger		Borger		Kansas City		Kansas City	
Operating conditions:	<—				Natural gasoline			—>				
Naphtha charge, B/D	4159		4750		4524		4525		2580		2564	
3_3 and C_4 poly charge, B/D	4819		4553		4697		4696		2376		2474	
Inlet pressure, psig	2200		2275		2275		2350		2800		2800	
Outlet pressure, psig	1500		1550		1575		1600		1300		1300	
Coil outlet temperature, F	982		1005		1017		1038		1063		1063	
Weight per cent of naphtha charge:	Coil charge	Coil yield	Coil charge	Coil yield	Coil charge	Coil yield	Coil charge	Coil yield	Coil charge	Coil yield	Coil charge	Coil yield
Hydrogen+methane	2.4	3.1	2.3	4.9	2.8	6.7	2.0	7.0	..	4.3	..	3.6
Ethylene	0.5	0.6	0.9	1.3	0.9	1.5	1.1	2.1	0.6	1.5	0.5	1.4
Ethane	14.2	17.7	14.5	19.1	16.9	24.3	12.6	24.0	2.8	9.9	4.6	10.5
Propylene	8.3	9.6	7.6	8.7	7.7	9.1	7.3	9.2	12.3	8.2	12.8	8.8
Propane	25.3	28.8	19.5	22.1	22.5	27.0	22.4	27.6	48.1	48.1	50.0	51.0
Iso-butylene	2.2	2.3	2.0	2.1	2.0	2.3	2.3	2.3	0.1	2.6	..	2.5
N-butylene	8.5	8.7	8.2	8.4	7.6	8.5	8.4	8.4	0.3	4.1	..	3.2
Iso-butane	7.1	7.4	3.3	3.3	2.9	3.0	4.7	4.7	0.5	2.7	0.4	1.9
N-butane	18.6	9.6	11.5	12.1	10.6	12.0	12.1	13.1	2.6	5.3	1.7	4.5
Pentanes to 400 F	100.0	87.0	100.0	84.9	100.0	75.8	100.0	70.0	100.0	78.6	100.0	79.0
400 F+	..	2.3	..	2.3	..	3.7	..	4.5	..	2.0	..	3.6
Total	187.1	187.1	169.8	169.8	173.9	173.9	172.9	172.9	167.3	167.3	170.0	170.0
Ethane and lighter formed, wt. per cent of naphtha charge	4.3		8.2		11.9		17.4		12.3		10.4	
Yield of BF, 400 F. E.P. gasoline in vol. per cent of naphtha charge		86.0		83.0		74.4		67.3		75.6		79.3
Inspection tests:	Naphtha charge	BF-400EP gasoline		BF-400EP gasoline		BF-400EP gasoline		BF-400EP gasoline	Naphtha charge	BF-400EP gasoline		BF-400EP gasoline
Gravity, API	75.8								63.5			
ASTM distillation, IBP., F	102								106			
5	113								130			
10	116								148			
20	120								175			
50	144								238			
90	230								333			
E.P.	398								398			
Per cent received	98.0								98.0			
ASTM octane number +0 cc TEL	54.0	63.8	54.0	68.2	54.0	70.8	54.0	72.0	49.5	70.1	49.5	70.9
+1 cc TEL	61.0	69.8	61.2	74.6	61.2	76.9	61.2	77.9	60.8	75.0	60.8	75.8
+3 cc TEL	67.8	77.2	67.8	80.9	67.8	82.0	67.8	82.0	70.3	79.5	70.3	80.4
Research octane number +0 cc TEL	59.5	67.2	59.5	72.4	59.5	77.3	59.5	79.4	52.0	77.8	52.0	79.9
+1 cc TEL	68.6	76.3	68.6	80.8	68.6	84.4	68.6	86.0	64.0	84.5	64.0	86.3
+3 cc TEL	76.2	83.1	76.2	86.8	76.2	89.8	76.2	91.2	73.7	89.7	73.7	91.3
Weight per cent sulphur	0.080	0.031	0.080	0.022	0.080	0.021	0.080	0.015	0.016	0.021	0.016	0.014

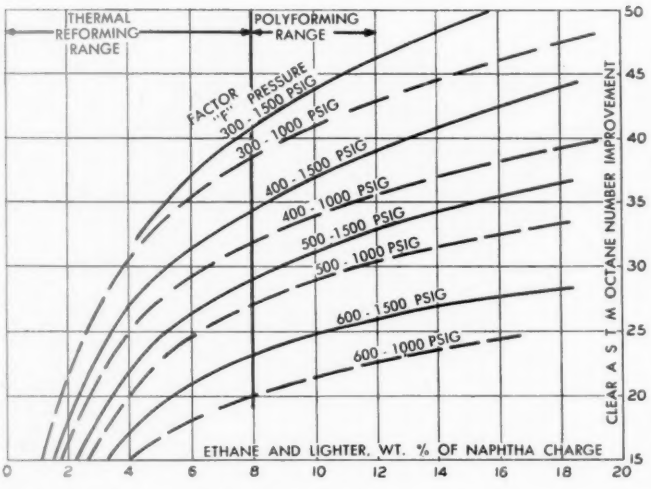
THERMAL REFORMING RANGE
POLYFORMING RANGE
FACTOR "F" PRESSURE
300 - 1500 PSIG
300 - 1000 PSIG
400 - 1500 PSIG
400 - 1000 PSIG
500 - 1500 PSIG
500 - 1000 PSIG
600 - 1500 PSIG
600 - 1000 PSIG
CLEAR A S T M OCTANE NUMBER IMPROVEMENT
ETHANE AND LIGHTER, WT. % OF NAPHTHA CHARGE

FIG. 4. Octane number improvements from thermal treatments of naphthas.

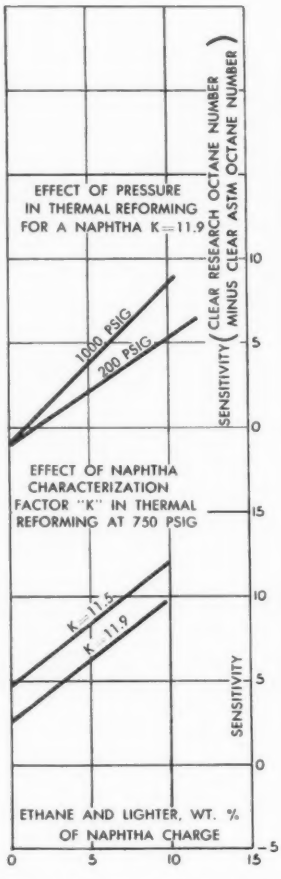
EFFECT OF PRESSURE IN THERMAL REFORMING FOR A NAPHTHA K=11.9
1000 PSIG
200 PSIG
SENSITIVITY (CLEAR RESEARCH OCTANE NUMBER MINUS CLEAR ASTM OCTANE NUMBER)
EFFECT OF NAPHTHA CHARACTERIZATION FACTOR "K" IN THERMAL REFORMING AT 750 PSIG
K=11.5
K 11.9
SENSITIVITY
ETHANE AND LIGHTER, WT. % OF NAPHTHA CHARGE

FIG. 5. Right, variation of sensitivity in thermal reforming.

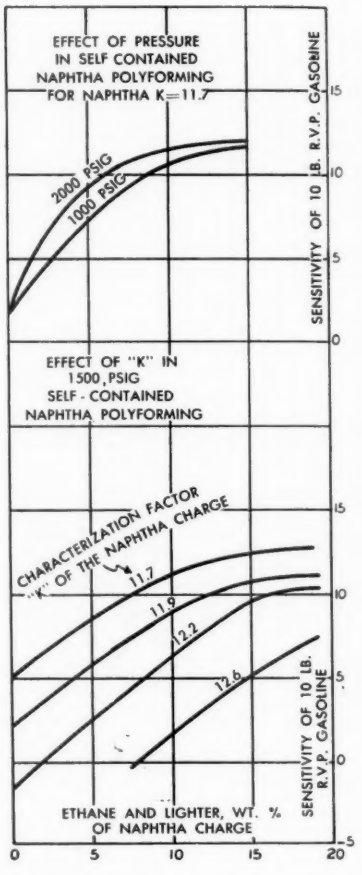
EFFECT OF PRESSURE IN SELF CONTAINED NAPHTHA POLYFORMING FOR NAPHTHA K=11.7
2000 PSIG
1000 PSIG
SENSITIVITY OF 10 LB. R.V.P. GASOLINE
EFFECT OF "K" IN 1500, PSIG SELF-CONTAINED NAPHTHA POLYFORMING
CHARACTERIZATION FACTOR "K" OF THE NAPHTHA CHARGE
11.7
11.9
12.2
12.6
SENSITIVITY OF 10 LB. R.V.P. GASOLINE
ETHANE AND LIGHTER, WT. % OF NAPHTHA CHARGE

Fig. 6. Far right, variation of sensitivity in self-contained naphtha polyforming.

Relationship of octane number improvement to severity factor. In self-contained naphtha polyforming, the clear ASTM octane number improvement is a function of the pressure, the characterization factor of the naphtha charge, the charge octane number, and the severity factor. Fig. 4 shows the octane number improvements at 1500 psig, and 1000 psig. These figures were drawn from data similar to that used for Fig. 3. Octane numbers of the naphtha charges are not sufficient by themselves to correlate with the octane number improvements. When the charge octane number is multiplied by the characterization factor of the charge, the product "F" is a factor against which octane number improvement may be correlated, when the effects of pressure and severity factor are taken into account.

Data for 2000 psig and 500 psig are available but are not included here since the optimum operating pressure is in the region shown.

From Fig. 4, the octane number improvements for thermal naphtha reforming and self-contained naphtha polyforming may be estimated. In general, thermal naphtha reforming is conducted at smaller severity factors than self-contained naphtha polyforming, and the octane number improvement by the two processes join in a smooth curve. From Fig. 4, it may be concluded that the size of the incremental octane number improvement obtained in self-contained naphtha polyforming depends upon the severity factor.

Variation of sensitivity with severity factor. In the thermal reforming of naphthas, the sensitivity (clear Research octane number minus clear ASTM octane number) of the gasoline produced increases with increasing pressure and with increasing severity factor. The sensitivity of the gasoline produced from a naphtha charge stock with a low characterization factor is larger than the sensitivity of the gasoline produced from a naphtha charge stock with a high characterization factor. These facts are shown in Fig. 5. The magnitude of the sensitivity of the gasoline produced varies probably with the magnitude of the sensitivity of the charge naphtha.

In self-contained naphtha polyforming, the sensitivity of the gasoline produced follows the same trends as in thermal reforming. That is, a low naphtha charge characterization factor, a high pressure and severe cracking tend to produce a large sensitivity in the finished gasoline as shown in Fig. 6. The upper half of Fig. 6 shows the effect of increasing pressure on the sensitivity of the gasoline produced. The bottom half of Fig. 6 shows the effect of characterization factor and severity factor of 1500 psig for self-contained naphtha polyforming. The sensitivity approaches a maximum value which is greater than that obtainable in thermal reforming, simply because the presence of the diluent gases permits a greater severity factor in polyforming than in thermal reforming. Beyond a certain severity factor it does not appear desirable to polyform for increased sensitivity of the finished gasoline since the curves tend to level off, especially for stocks with low characterization factors. However, the maximum sensitivity is usually above that obtained in thermal reforming and it may be achieved at shallow depths of cracking at high operating pressures.

Significance of the correlation. The gasoline yields and the octane number improvements from self-contained naphtha polyforming have been directly related to those from thermal reforming of naphthas. The effect of withdrawing part of the C_3's and C_4's instead of recycling them has been related to the gasoline yield. The sensitivity of the finished gasoline has been shown to be a function of the severity of treatment, the characterization factor of the naphtha charge, and the pressure.

Literature cited.

1. Offutt, W. C., Ostergaard, P., Fogle, M. C. Beuther, H. *Petroleum Refiner, 25*, 11, 554 (1946).
2. Hirsch, J. H., Ostergaard, P., Offutt, W. C., *Petroleum Refiner, 25*, 11, 570 (1946).
3. Bogk, J. E., Ostergaard, P., Smoley, E. R., "The Naphtha Polyform and Gas Reversion Processes." Paper presented to Division of Refining, 21st Annual Meeting of The American Petroleum Institute, Chicago, November 13, 1940.

* * *

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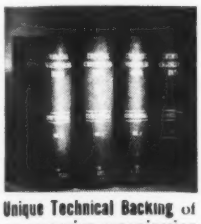

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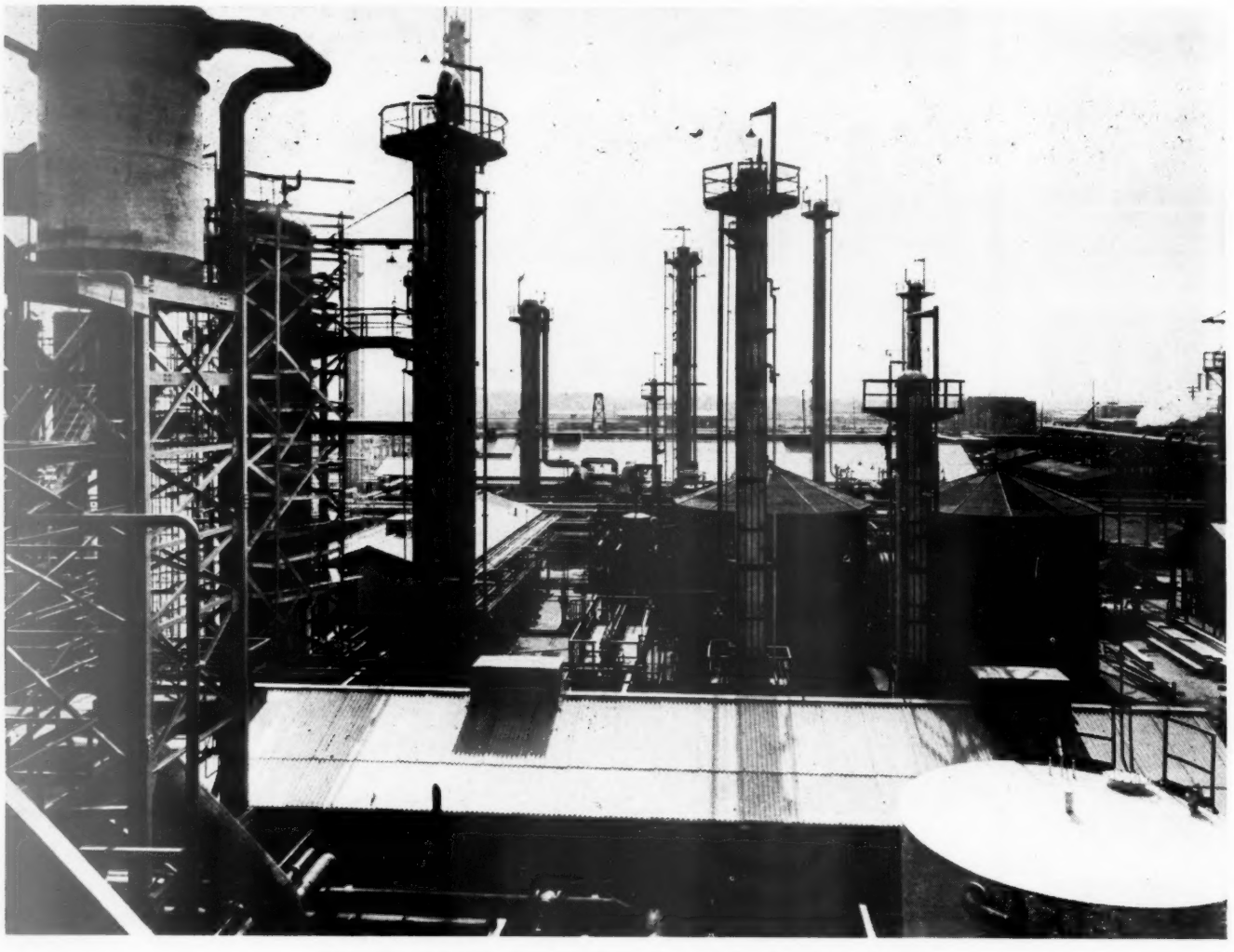


Columns and storage tanks at synthetic glycerine plant, Houston.

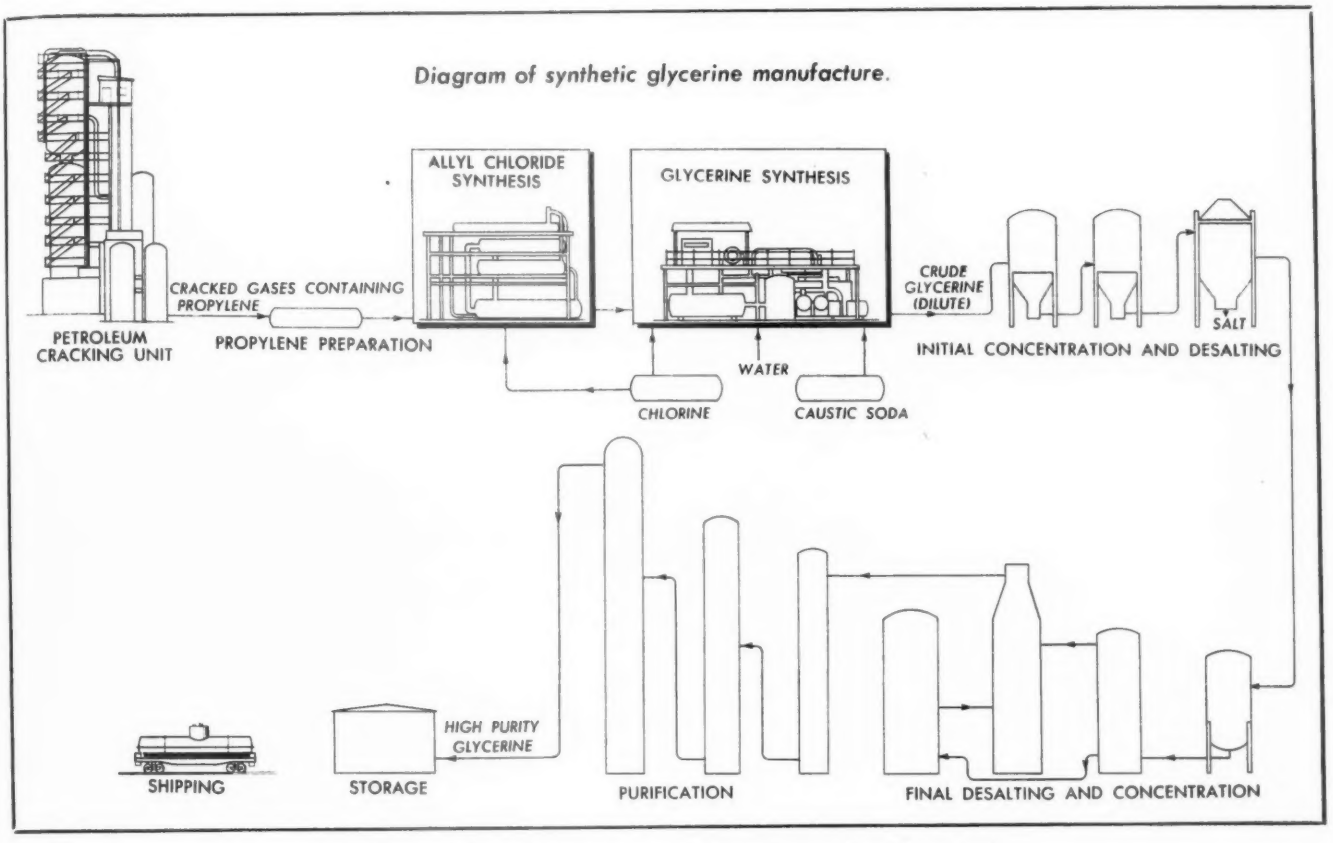
Synthetic Glycerin Plant Goes on Stream

By ARCH L. FOSTER, *Refining Editor*

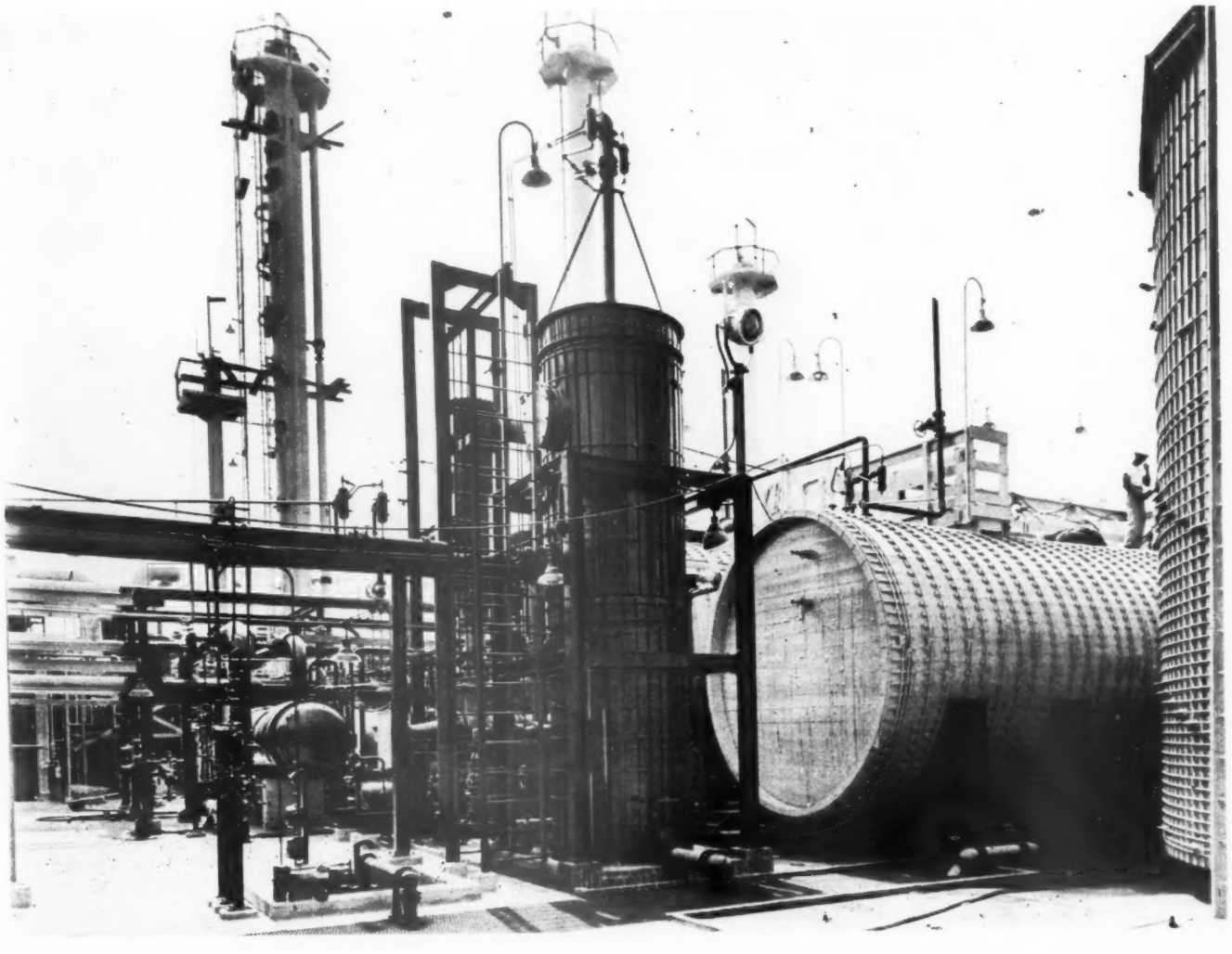
CLIMAXING a study begun nearly 20 years ago, Shell Chemical Company began operation in mid-September of the world's first commercial synthetic glycerine plant, near Houston, Texas. This unit, operated along with other units built and building for the manufacture of various synthetic petroleum chemicals, marks a distinct departure in the annals of chemical development. Formerly obtainable only from the saponification of animal fats, glycerine has been in short supply for several years, especially during the recent World War II. It is employed as the basis of nitroglycerine, one of the most widely used high explosives, and in a very great number of industrial and commercial products of every conceivable type. The new plant has cost $8,000,000 to build, it is announced.

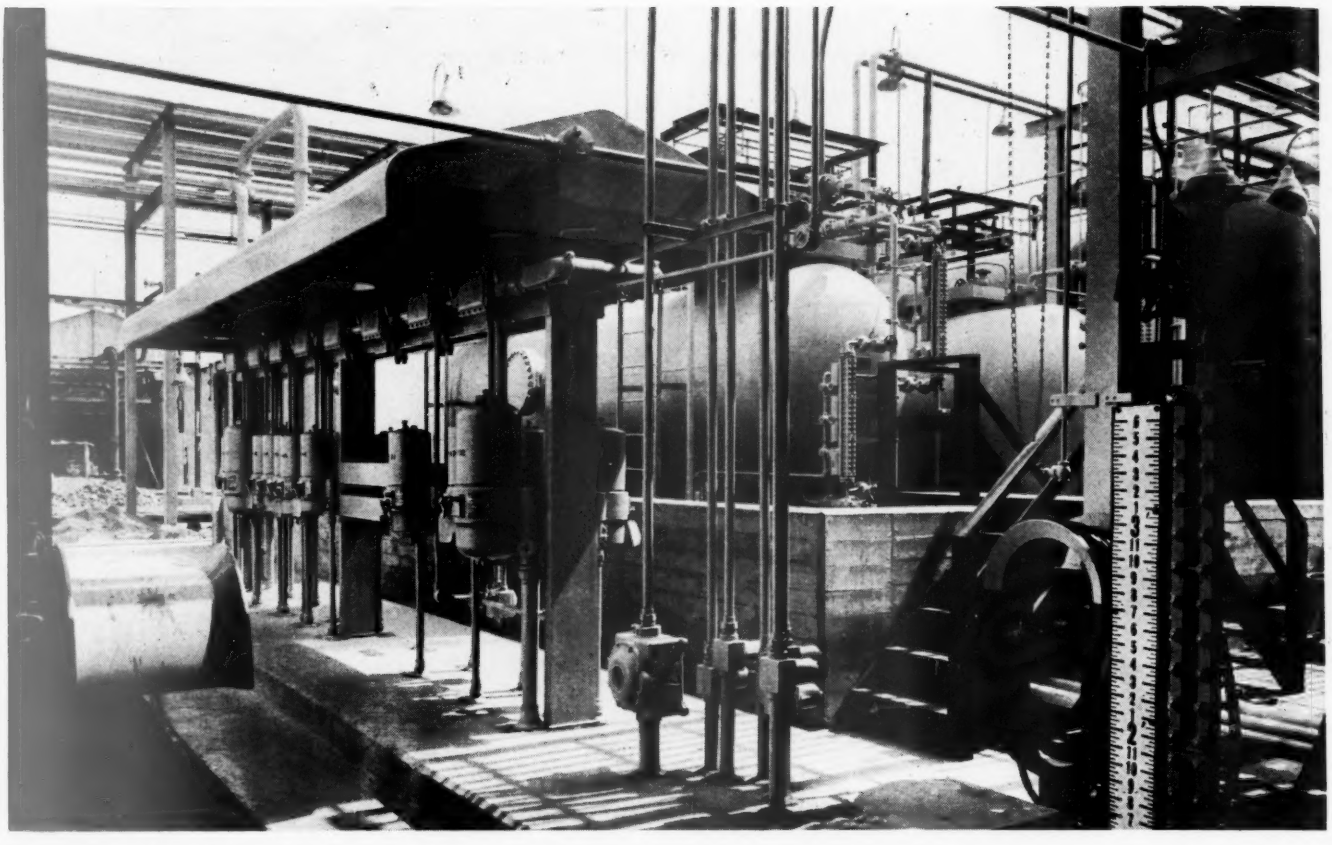
Research on the synthesis of glycerine was begun by Shell Development nearly 20 years ago, along with study of the preparation of allyl chloride, both from propane as base material. Early work indicated that allyl chloride was the best intermediate for synthesizing glycerine and that tack was followed carefully. Synthesis of allyl chloride was carried out after extensive investigation of the mechanism of substitution of hydrogen by chlorine in an olefinic molecule in preference to the introduction of the chlorine by breaking the double bond. This step was perfected, so that when treating propylene, derived from cracking still gases but obtainable direct by dehydrogenating propane, with molecular chlorine the chlorine replaces one of the hydrogen atoms remaining in the propylene instead of breaking into the double bond and

Diagram of synthetic glycerine manufacture.

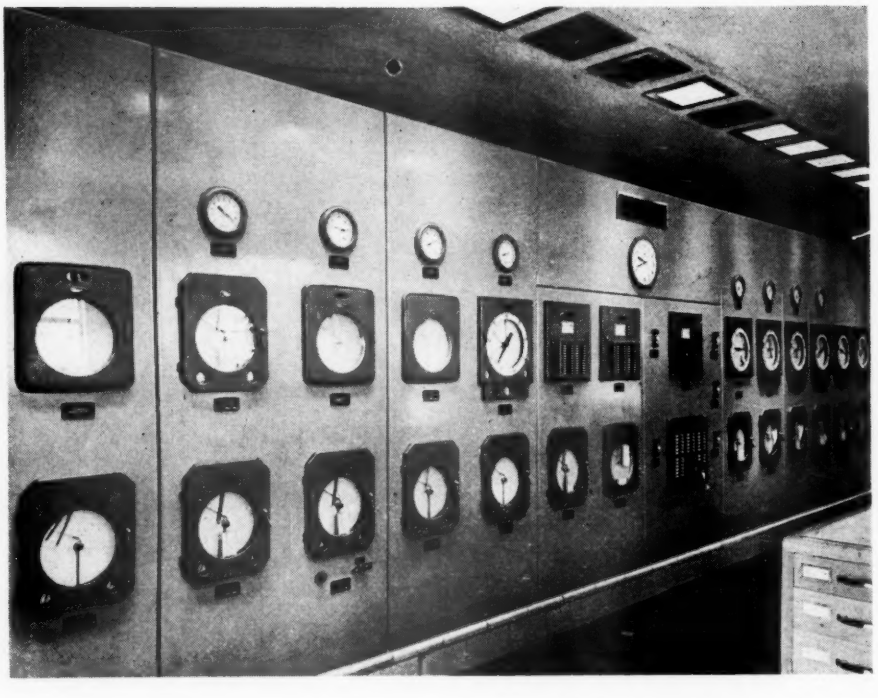


A close-up of equipment in operation at new glycerine plant.





Overload relays shown here are for protection of circuits and equipment at Houston, Texas, plant where glycerine is synthesized from petroleum.



Nerve center of Shell chemicals plant is the control panel. From this point operations in all sections of unit are observed and recorded.

thus destroying the olefin character of the propylene. By proper control of temperature, pressure, concentration of reacting materials, and time the synthesis is carried out successfully.

▸ **Chemical reactions.** The first step in the synthesis is the reaction of propylene, concentrated from still gases, with molecular chlorine under carefully controlled conditions, including elevated temperature, the exact temperature not having been disclosed by the company. Various side reactions occur and the desired allyl chloride is recovered by concentration in distillation equipment.

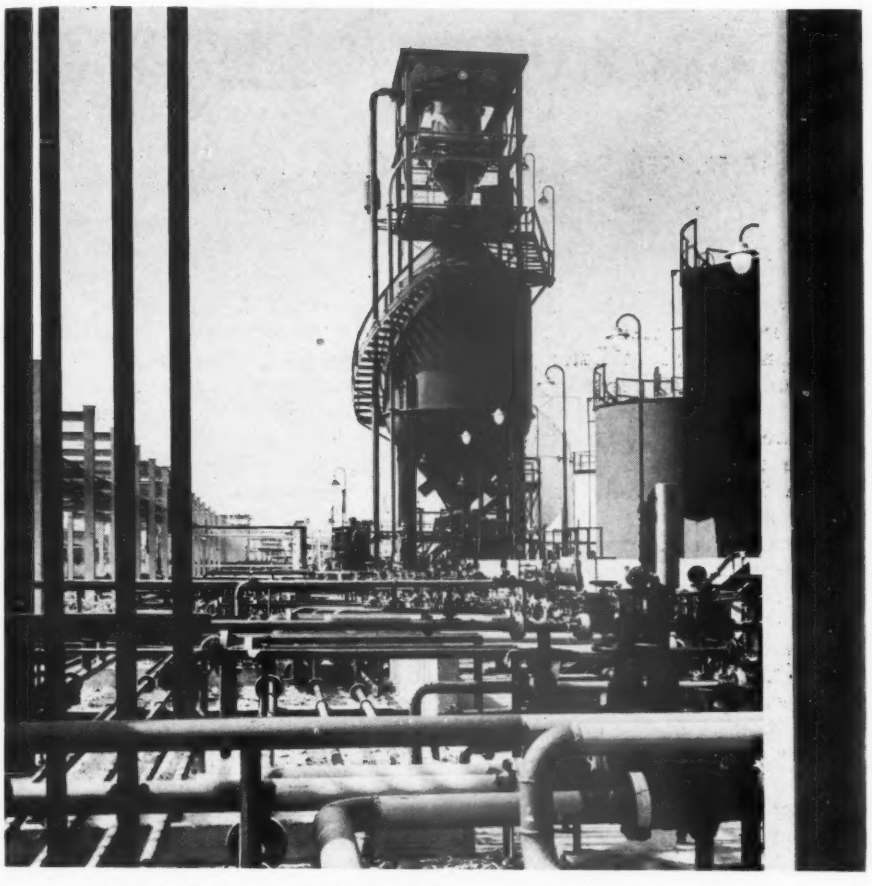
$$\underset{\text{Propylene}}{2\,H_2C=CH-CH_3} + \underset{\text{Chlorine}}{Cl_2} = \underset{\text{Allyl Chloride}}{2\,H_2C=CH-CH_2Cl} + \underset{\text{Hydrogen}}{H_2}$$

The reactions involved are without doubt much more complicated than is indicated by the equation shown, but the net results are essentially as given.

In a second step the allyl chloride then reacts with caustic soda, NaOH, and chlorine in water to form crude glycerine in dilute water solution:

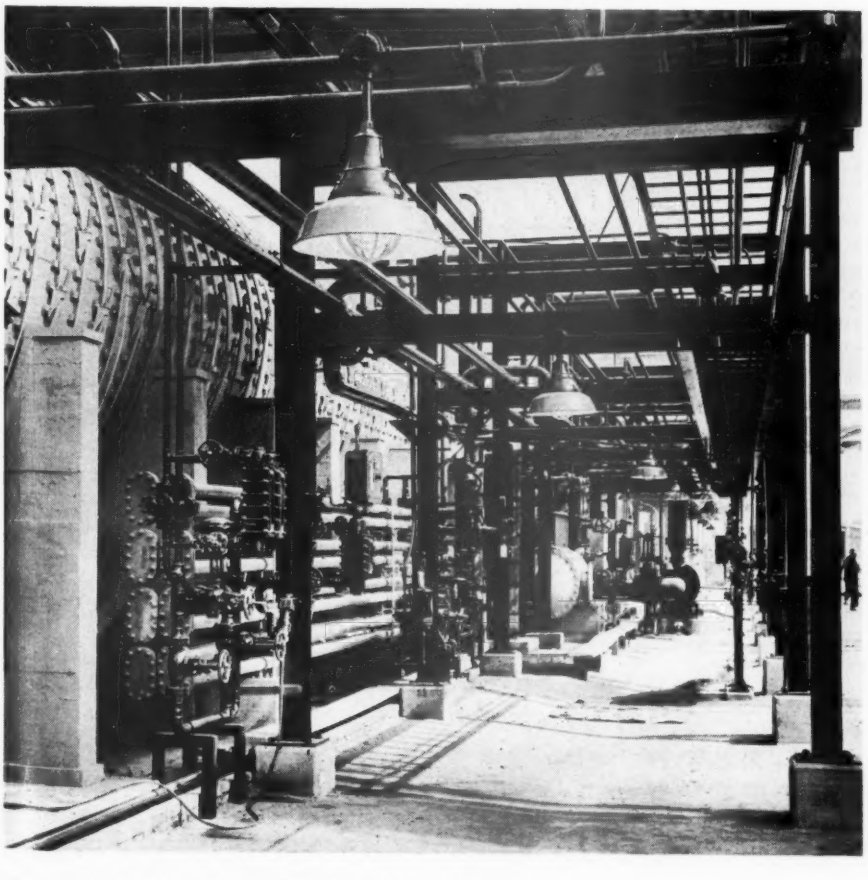
$$H_2C\,CH-CH_2Cl + NaOH + Cl_2 + H_2O = \underset{\text{Glycerine solution in water}}{(H_2C(OH)-CH(OH)-CH_2(OH)+H_2O)} + 3\,NaCl.$$

One of the largest problems is that of concentrating the glycerine-salt solution and separation of the two products. This raw solution is pumped into multiple effect evaporators, reported to have "over a quarter of an acre of heating surface." The solution drawn from the last stage of evaporators is a salt-glycerine slurry in water,



Chemical storage facilities and complex piping at Shell unit.

Pipeway and operating equipment at glycerine plant.



which is settled in a tank. Much of the salt, which is crystallized, is removed in the tank by settling to its bottom. and the glycerine solution is pumped out for further concentration in other evaporators. Final desalting under vacuum is carried out, and the glycerine is purified by removal of various products formed by side reactions during the synthesis, to yield finally a product containing 99-plus per cent glycerine.

Shell Receives 1948 Award

Shell Development Company has been awarded the 1948 Chemical Engineering Award, according to announcement by Professor Alfred H. White, chairman of the 50-man Committee of Award. The award is made in recognition of the company's signal contribution to chemical engineering advancement in its development of the first commercial process for synthesis of glycerine, which is discussed in the accompanying article. The award is sponsored by Chemical Engineering published by McGraw-Hill Publishing Company.

▸ **Industrial applications of glycerine.** Industrial uses of glycerine were few until Sobrero discovered the reaction for the nitration of glycerine in 1847, to produce nitroglycerine, in which each hydroxyl group, — CH, is replaced by the nitro group, — NO_2. This high explosive was absorbed in diatomaceous earth, called by the Germans kieselguhr, by Nobel to form so-called dynamite, a form easier to handle and which has been employed widely as a peacetime explosive throughout the world. Nitroglycerine is employed also as an ingredient of gunpowder and of high explosive military projectiles as a bursting charge. In medicine it is used as a most powerful heart stimulant.

In all, more than 1500 different uses for glycerine in industrial and commercial products have been developed. Discovery by medical researchers that the human body converts about 10 per cent of the fat taken in into glycerine gave reason to permit the employment of glycerine in the processing of foods. One of its very largest uses is in the preparation of alkyd resins and ester gums, some 40,000,000 lb of glycerine having been consumed for these products alone in 1941. When it is realized that 30,000,000 lb is used each year for explosives, 20,000,000 lb annually for cellophane, the commercial importance of its synthesis can be understood.

* * *

Hydrogen and Synthesis Gas Production*

R. M. REED and ARNE ERIKSEN, The Girdler Corporation

Abstract. *Reacting steam and light hydrocarbons at 1600 F over a nickel catalyst to form hydrogen and carbon monoxide, oxidation of the monoxide to dioxide with an iron catalyst at 850 F and removing the dioxide with ethanolamine solution is a commercial method for producing high purity hydrogen for ammonia synthesis and other purposes. Preparation of a mixture of carbon monoxide and hydrogen suitable for the Fischer-Tropsch hydrocarbon synthesis may be made efficiently by replacing part or all the steam with carbon dioxide and reacting with the hydrocarbon. This reaction also is employed to produce make-up gas for fuel gas systems.*

THE hydrocarbon-steam process for the production of hydrogen and various mixtures containing carbon monoxide and hydrogen has become increasingly important in recent years. This paper will present a brief description of this process together with typical applications of its current use in various fields.

Hydrocarbons will react with steam over catalysts at elevated temperatures so that the hydrocarbons are almost completely converted to carbon oxides and hydrogen. The two principal reactions which occur with the paraffin hydrocarbons are as follows:

$$(1)\quad C_nH_{(2n+2)} + nH_2O = nCO + (2n+1)H_2$$

$$(2)\quad C_nH_{(2n+2)} + 2nH_2O = nCO_2 + (3n+1)H_2$$

These reactions are both endothermic. Reaction (2) is considered to be the summation of reaction (1) and:

$$(3)\quad nCO + nH_2O = nCO_2 + nH_2$$

Hydrogen for petroleum hydrogenation. Althought the patent literature in connection with this process dates back to about 1880, the first large-scale commercial development of the process in this country was for the purpose of producing relatively pure hydrogen, and was carried out by the Standard Oil Company of New Jersey through its development company working jointly with I. G. Farbenindustrie. A large plant was installed at Bayway, New Jersey, in 1930 and a second and larger plant was placed in operation in 1931 at Baton Rouge, Louisiana. In this latter plant, natural gas was reacted with steam to produce a mixture of carbon monoxide, carbon dioxide and hydrogen at about 1600 F in a furnace containing vertical chrome-nickel alloy steel tubes. The furnace tubes contained a nickel catalyst supported on a refractory material. The hydrocarbon-steam reaction occurred as the natural gas and steam were passed down through the tubes. On the outlet of the furnace, the gaseous products were cooled by the addition of more steam, and the mixture was then passed through a catalytic converter containing an iron oxide catalyst which promoted the oxidation of carbon monoxide to carbon dioxide (reaction [3] above). This reaction took place at about 850 F. The gas mixture from the catalytic converter was cooled and stored in a gas holder. This gas contained about 77 per cent hydrogen with about 18 per cent carbon dioxide and the balance carbon monoxide, methane and nitrogen. On removing the carbon dioxide from this gas mixture by scrubbing with monoethanolamine solution (the Girbotol process), a hydrogen gas was obtained which contained about 95 per cent hydrogen together with roughly 1.5 per cent methane, 2.0 per cent carbon monoxide, 1.5 per cent nitrogen (present originally in the natural gas), and a trace of carbon dioxide.

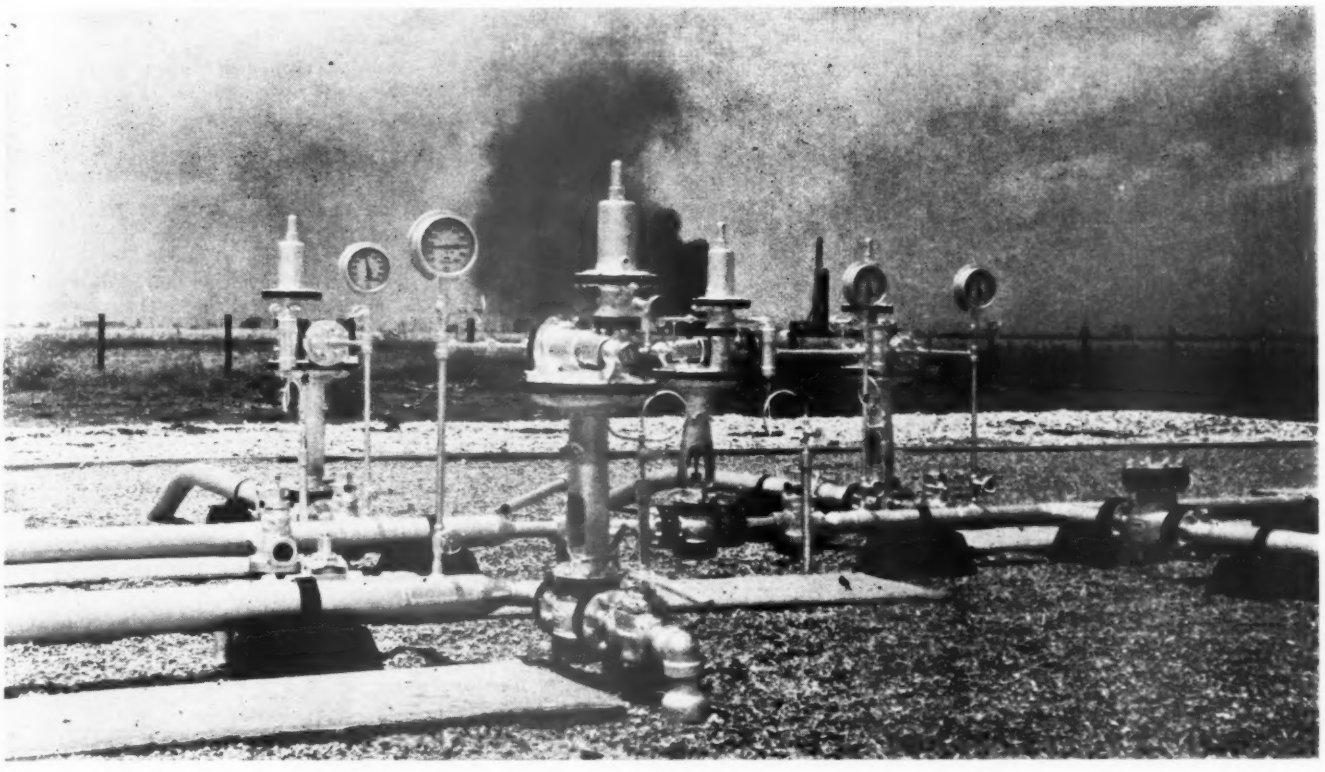
This gas was suitable for the hydrogenation of various petroleum materials and has been used off and on for this purpose on a large scale since 1931, particularly during the last war. Several other rather large plants have also been installed since 1931 for the production of hydrogen for the hydrogenation of petroleum products, namely at Port Arthur, Texas; Whiting, Indiana; Salt Lake City, Utah; Richmond, California; and Aruba, N.W.I., but some of these have discontinued operation as a result of the development of more economical processes for producing all grades of gasoline.

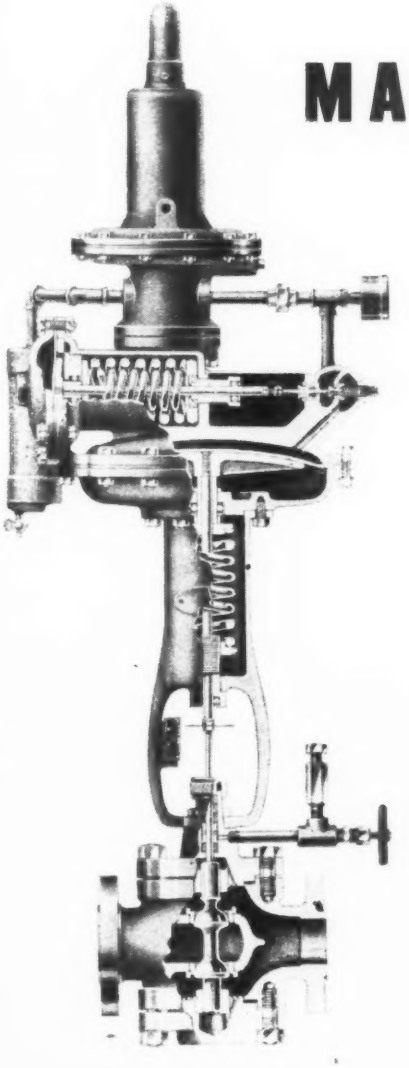
Hydrogen for ammonia synthesis. The second large-scale utilization of the hydrocarbon-steam process for the production of hydrogen-containing gas mixtures has been in the field of ammonia synthesis. This process has been employed on a large scale in the following synthetic ammonia plants: Hercules Powder Company at Hercules, California and Louisiana, Missouri (Missouri Ordnance Works); Alberta Nitrogen Products Limited at Calgary, Alberta; Spencer Chemical Company, Pittsburg, Kansas (Jayhawk Ordnance Works); Lion Oil Refining Company, El Dorado, Arkansas (Ozark Ordnance Works); Commercial Solvents Company, Sterlington, Louisiana; (Dixie Ordnance Works); Mathieson Chemical Corporation, Lake Charles, Louisiana; and Cactus Ordnance Works, Dumas, Texas. These plants have been able to produce synthetic ammonia at very reasonable cost and their operation has been highly successful. Sulphur compounds, which are troublesome impurities in ammonia synthesis gas made from coke, are not present in synthesis gas made by the hydrocarbon-steam process.

Several methods are in use for introducing nitrogen into the hydrogen gas to obtain the desired 3:1 hydrogen-nitrogen ratio for ammonia synthesis. Flue gas from the cracking furnace may be cooled, compressed and introduced with the steam and hydrocarbon in the furnace feed; hydrocarbon gas may be burned in an inert gas generator and the resulting flue gas introduced into the cracking furnace effluent; or air in the proper ratio may be introduced into the furnace effluent so that the oxygen is reacted with some of the hydrogen, leaving the proper hydrogen-nitrogen ratio.

Carbon monoxide in the ammonia synthesis gas is removed largely by converting it to carbon dioxide as has already been described for the petroleum hydrogenation plants. Carbon dioxide is removed in some cases by the Girbotol absorption process and in other cases by absorption in water after compressing the gas to 300 or 400 lb per sq in. Small concentrations of carbon dioxide remaining after the water scrubbing step are removed by further scrubbing with caustic soda solution. The small concentration of carbon monoxide remaining after the

*Presented before California Natural Gasoline Association, August 5, 1948.





MASONEILAN REGULATORS

Guard Main Lines Against Excess Pressure

In this Texas Gulf Coast installation furnished by Maintenance to conserve natural gas, the group of Masoneilan regulators shown above is only one section of the system. These regulators are used to control the suction pressure on the main line to the compressor, and to protect the main line and separators from excess pressure. This is the 2" type No. 27 Reducing and the type No. 47 Back Pressure Masoneilan regulators, shown in cut-away picture at the left.

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conversion step is removed by scrubbing the gas with ammoniacal copper solution or by passing it over a special catalyst or spent ammonia synthesis catalyst to react the carbon monoxide with hydrogen to form water vapor and methane. This step is usually termed methanation and the reaction is the reverse of reaction (1) above. Thus, conventional ammonia synthesis gas made from hydrocarbons and steam consists essentially of a 3:1 mixture of hydrogen and nitrogen with a small percentage of methane as impurity. The methane is separated by purging after the ammonia has been synthesized and liquefied.

Synthesis of ammonia is carried out over a catalyst at about 800 F and at a pressure of approximately 4500 psi in some plants.

In other plants the pressure is held at approximately 14,000 psi. At the lower reaction pressure considerably more recycling of the synthesis gas over the ammonia catalyst is required, but in both cases utilization of the hydrogen-nitrogen mixture is virtually complete and only a small amount of gas is purged to rid the system of accumulated methane, argon, and other fixed gases.

▸ **High-purity hydrogen.** The hydrocarbons used in the plants mentioned above have been natural gas and refinery gases, both of which are normally gaseous mixtures. Several years ago, The Girdler Corp. adapted the hydrocarbon-steam process to the production of hydrogen of high purity, utilizing propane and butane as process materials so that hydrogen plants could be built in locations in which natural gas or refinery gases are not available. In addition to their relativelv greater availability, propane and butane are advantageous process materials for use in cases in which it is necessary to produce hydrogen entirely free from nitrogen since much of the natural gas in the country does contain some nitrogen which appears in the finished hydrogen. Where suitable natural gas is available, however, high-purity hydrogen can be, and is, produced by this process. Pilot plant work on the use of hydrocarbons in the gasoline range and heavier for feed material to steam-hydrocarbon furnaces is now being conducted by The Girdler Corp.

High-purity hydrogen has found its principal use in the hydrogenation of various animal and vegetable oils in the presence of nickel catalysts. In such operations, it is necessary to use hydrogen substantialy free from carbon monoxide since this impurity is a catalyst poison under the conditions employed in such hydrogenations. It is also necessary for the hydrogen to be entirely free from sulphur compounds. Both of these impurities are eliminated effectively from the finished hydrogen during its production.

A typical plant for the production of high-purity hydrogen from propane or butane will include the following sections:

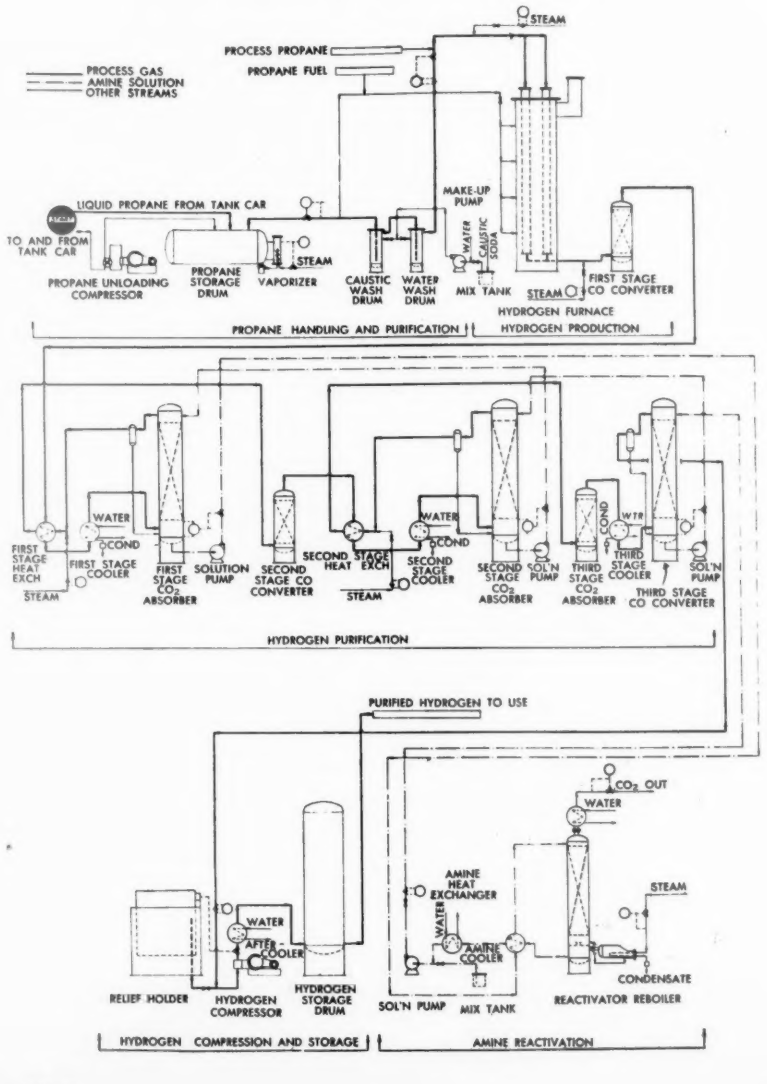
1. Hydrocarbon handling and purification,
2. Hydrogen production,
3. Hydrogen purification,
4. Amine reactivation,
5. Hydrogen compression and storage.

The flow diagram for Girdler's Hygirtol hydrogen manufacturing plant is shown in Fig. 1. A plant of this type will produce hydrogen of sufficient purity to be utilized in all applications requiring pure hydrogen except for those few specialized uses such as the heat treating of vacuum tube electrodes in which traces of carbon compounds cannot be tolerated. Hygirtol plant hydrogen however, can be purified further so as to be suitable for this use also.

The storage and handling of propane and butane is carried out in the same manner as is done in ordinary LPG installations. Storage tanks of such size are provided that tank car shipments of liquid hydrocarbons may be unloaded and stored. Conventional vaporizers are employed to vaporize the liquid hydrocarbon as needed.

Since commercial propane and butane may contain traces of sulphur compounds, either present as impurities or added as odorants, it is necessary to desulphurize these materials before they are utilized for hydrogen production. There are several simple methods available for effecting this desulphurization. In the flow diagram shown here, a caustic wash and a water wash are employed. This method is suitable for removing traces of mercaptans such as might be present in propane or butane obtained from natural gasoline. When handling materials obtained from refinery operations which may contain impurities

FIG. 1. Flow diagram Girdler Hygirtol plant.



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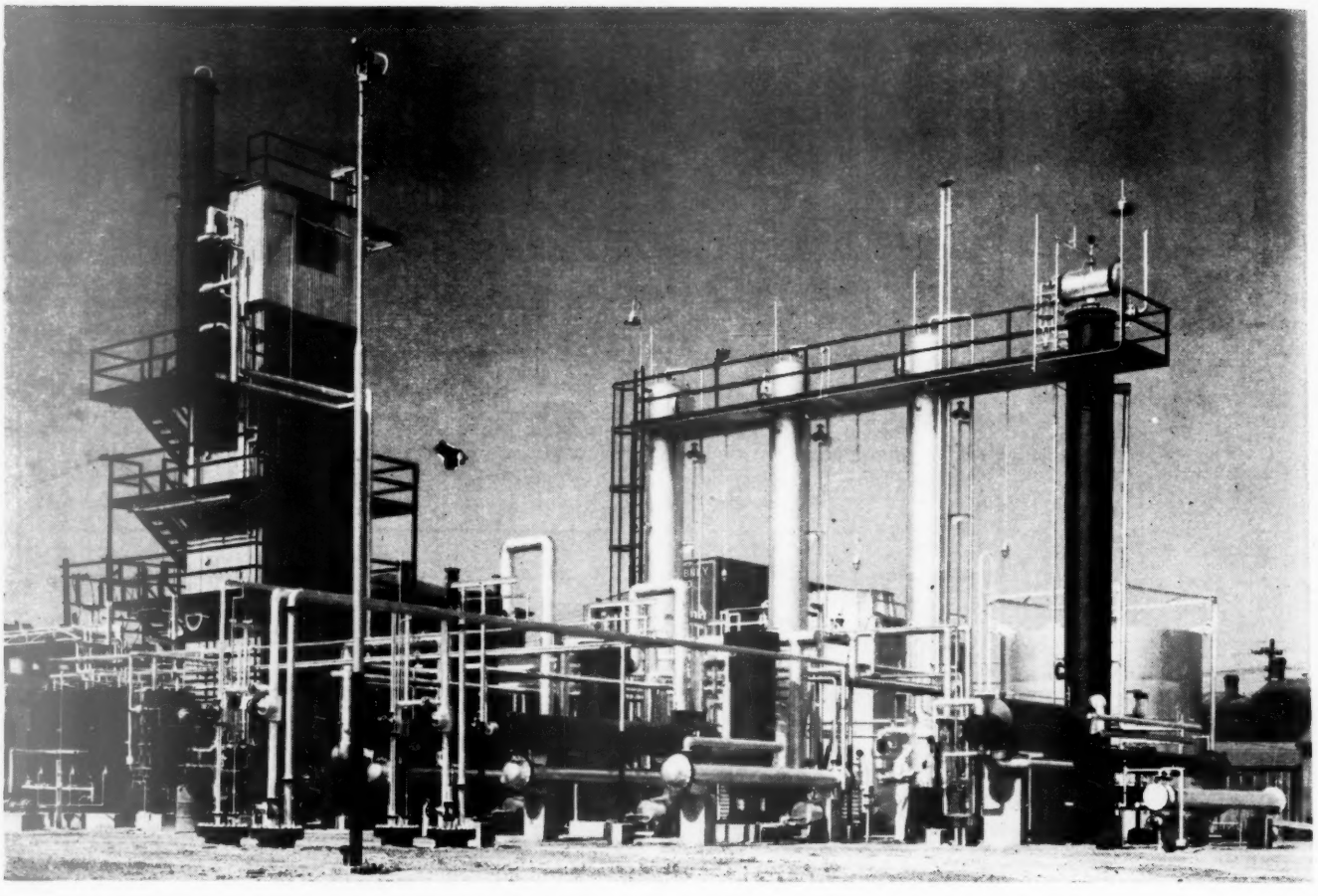

FIG. 2. Girdler Hygirtol high purity hydrogen manufacturing plant.

such as carbonyl sulphide, it is necessary to employ a catalytic process for treating the feedstock.

The hydrogen production section of the plant consists of the hydrogen furnace itself containing vertical alloy steel tubes filled with a supported nickel catalyst through which the hydrocarbon-steam mixture is passed at a temperature of about 1400 to 1600 F. At the outlet of the furnace, steam is added to the product gas stream to cool it to about 700 F before it enters the first-stage converter where most of the carbon monoxide is converted into carbon dioxide and hydrogen. From the outlet of the converter, the hot product gases pass through the first-stage heat exchanger, then through a cooler and into the first-stage carbon dioxide absorber. In this absorber, the carbon dioxide present in the gas mixture is removed by scrubbing with aqueous monoethanolamine solution. The product gas leaving the absorber is mixed with steam, passed back through the first-stage heat exchanger to reheat it to 700 F, and then passed through the second-stage carbon monoxide converter in which more of the carbon monoxide present in the gas reacts to produce carbon dioxide and hydrogen. The hot gases from the converter pass through another heat exchanger and cooler and then enter the second-stage carbon dioxide absorber. Here again carbon dioxide is removed from the gas stream by scrubbing with the monoethanolamine solution and the purified gas is again mixed with steam, passed through the heat exchanger and into the third-stage carbon monoxide converter. On the outlet of this converter the gas stream passes through a final cooler and into the third-stage carbon dioxide absorber in which the carbon dioxide produced in the third-stage carbon monoxide converter is scrubbed from the purified hydrogen stream by the monoethanolamine solution. Methanation, mentioned above, is sometimes used in place of the third stage of conversion.

The hydrogen produced in a Hygirtol plant of the type shown in Fig. 1 has approximately the following analysis:

Component	Mol. per cent
CO_2	0.01
CO	0.01
CH_4	0.10
N_2	0.01
O_2	0.00
H_2	99.87
	100.00

Hydrogen of this purity has been found suitable for use in the hydrogenation of edible oils and in other operations where high-purity hydrogen is required.

The carbon dioxide removal in this hydrogen plant is effected in a typical Girbotol unit in which the monoethanolamine solution is reactivated by steam stripping in a packed or plate reactivator tower and in which the absorption is carried out in three stages with the same solution being used in series in the three absorbers.

A photograph of a Hygirtol hydrogen plant of the type just described is shown in Fig. 2. At the left may be seen two caustic scrubbers and a water scrubber for removing sulphur compounds from the process propane. The top flanges of the two underground propane storage tanks may be seen in the left foreground with the propane vaporizer appearing just behind them. The hydrogen furnace is shown in the left rear portion of the picture while the three carbon monoxide converters may be seen in the center just behind the two gas heat exchangers and the three gas coolers. The three carbon dioxide absorbers are shown at the right with the Girbotol plant reactivator at the extreme right. The water cooling tower and the hydrogen gas holder may be seen in the rear.

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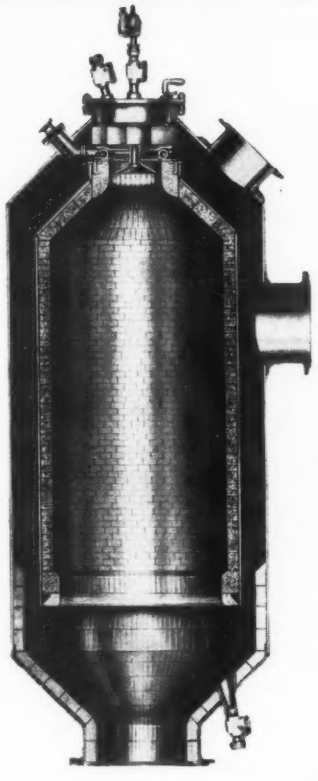

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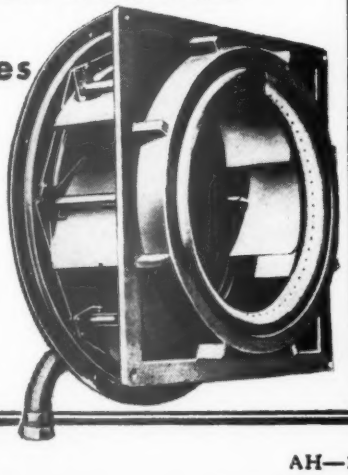

Either gas or oil may be burned alone or simultaneously in these burners. Complete control of flame characteristics by perfect air-flow, fuel-flow, and fuel-air mixing principles offers dependable and economical operation. Gas ring can be removed while burner is in operation.

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The cost of producing hydrogen in a plant of this type will depend upon the cost of the process materials as well as utility and labor costs. The process material and utility requirements for producing pure hydrogen in a typical Hygirtol plant are approximately as follows per thousand cubic feet of hydrogen:

Material	Quantity per MCF of H_2
Process material, propane	2.75 gal
or natural gas	250 cu ft
Fuel (gas or oil)	250,000 Btu
Steam	380 lb
Cooling water (30 F rise)	1600 gal
Power	2 kw-hr
Chemicals	2 cents

The operation of the plant is continuous and requires only part-time supervision by one attendant. In most locations, the major equipment can be placed outdoors as shown in the plant in Fig. 2.

Pure carbon dioxide is obtained as a byproduct in Hygirtol plant operation. This amounts to approximately 35 pounds of carbon dioxide per thousand cubic feet of hydrogen produced. By the addition of scrubbing and compression equipment, liquid carbon dioxide may be recovered for sale or use. The carbon dioxide gas produced by the plant is also suitable for firefighting, purging and blanketing operations.

Another important use for high-purity hydrogen as produced in a Hygirtol plant is in the preparation of anhydrous hydrogen chloride for plastics manufacture and other purposes. Although hydrogen and chlorine as made in the conventional electrolytic process can be and are being used directly for this purpose, it has proved to be more economical for some plant locations to have chlorine shipped in by tank car and to prepare hydrogen gas separately from propane which is also shipped in by tank car.

A third use for high-purity hydrogen is in the synthesis of organic chemicals derived from light petroleum hydrocarbons. A large chemical plant* near Bishop, Texas, is now using substantial quantities of high-purity hydrogen in the synthesis of a number of organic chemicals.

At the present time, there are some ten Hygirtol high-purity hydrogen plants in operation with an equal number in various stages of construction. In size, some of these plants are smaller than the petroleum hydrogenation or the ammonia synthesis gas plants, having daily hydrogen production rates ranging from about 100,000 to 1,000,000 standard cubic ft per day. The rapidly increasing number of these plants attests to their economy and efficiency. Designs have been developed for much larger plants of this type and designs are being completed for smaller plants to satisfy the needs of some small users of hydrogen, particularly in the edible fats and chemical fields.

(*The Celanese chemical plant—Ed.)

▸ **Hydrogen-carbon monoxide mixtures.** Since the gas mixture resulting from the steam-hydrocarbon reaction consists of carbon monoxide, carbon dioxide and hydrogen, it is possible to produce mixtures of carbon monoxide and hydrogen which are suitable for use in various synthesis operations such as the methanol and Fischer-Tropsch syntheses. In order to obtain the high $CO:H_2$ rations required in many of these synthesis gas mixtures, it is necessary to introduce carbon dioxide into the reformer furnace to replace part or all of the steam used to react with the hydrocarbon. The following reaction is involved:

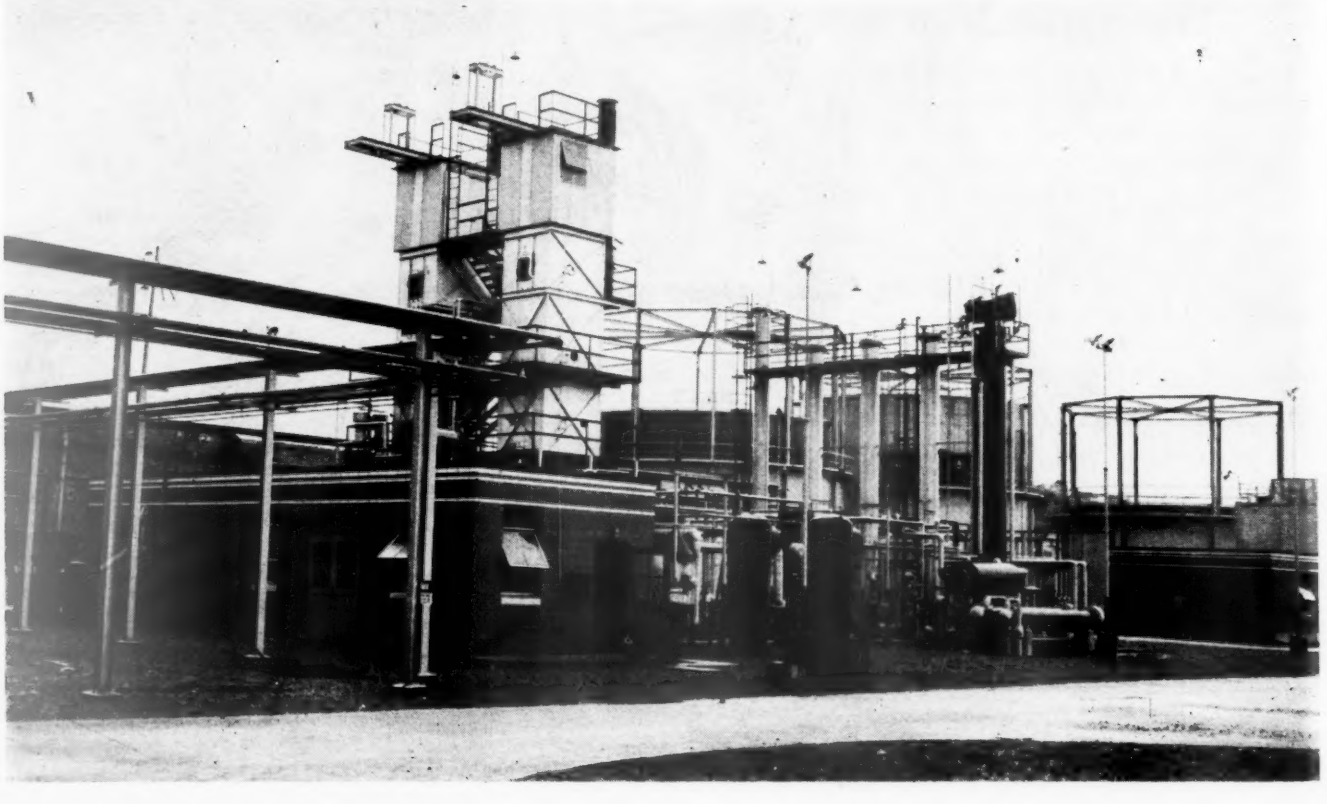
$$(4)\quad C_nH_{(2n+2)} + nCO_2 = 2nCO + (n+1)H_2$$

Under many conditions the reactions can be carried out so that there will be only a small amount of carbon dioxide in the product gas, but if complete carbon dioxide removal is required, this component can be removed by Girbotol scrubbing.

A synthesis gas production plant has been built recently for the Bureau of Mines at Bruceton, Pennsylvania by The Girdler Corp. A view of this plant is shown in Fig. 3. It will be

Continued on Page 290

FIG. 3. Synthesis gas production plant.



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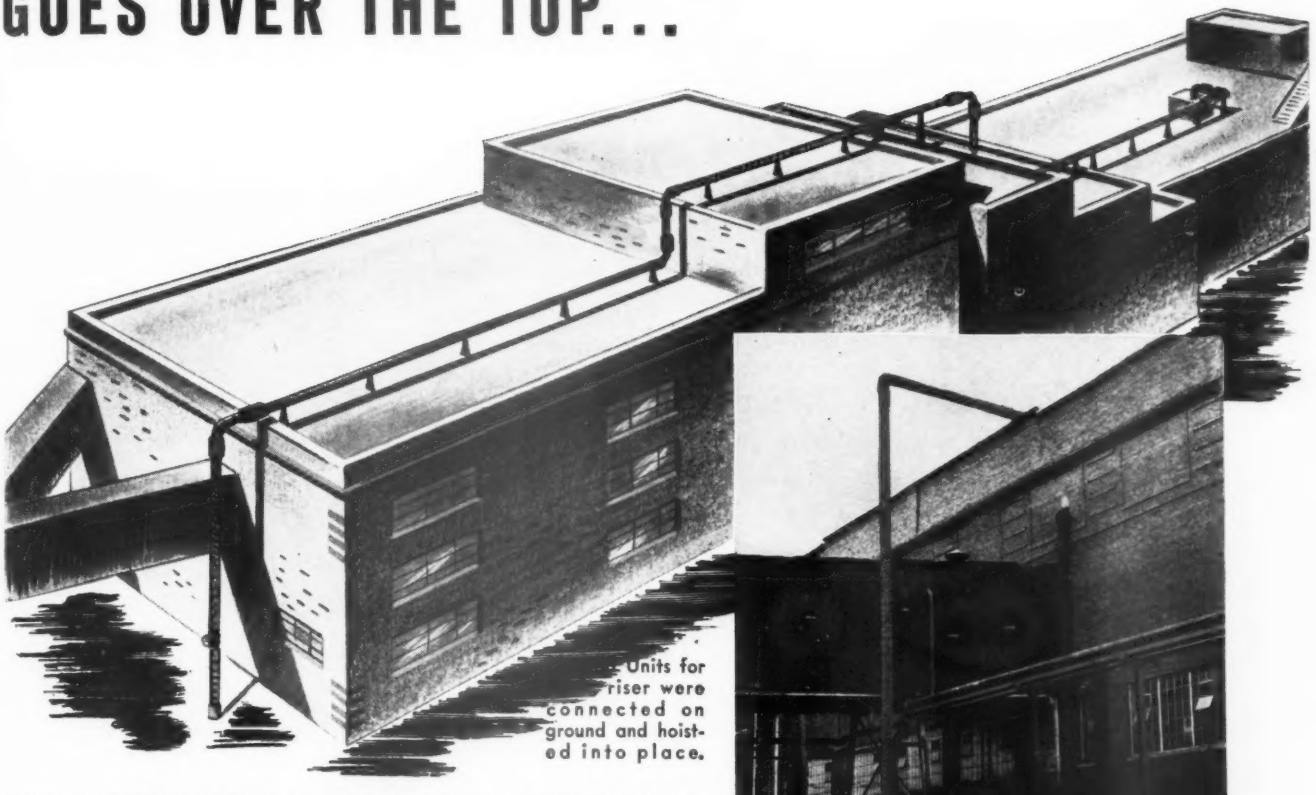

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The line connects to a supply system running underground and rises vertically to form a huge expansion loop supported on the roof. Desired flexibility is obtained by shaping the structure to conform with roof contour and changes of roof elevation. The vertical pipe tangents absorb horizontal movement of the line due to expansion, while horizontal tangents perform a similar function with respect to vertical movement.

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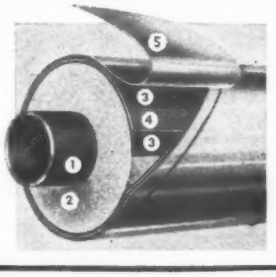

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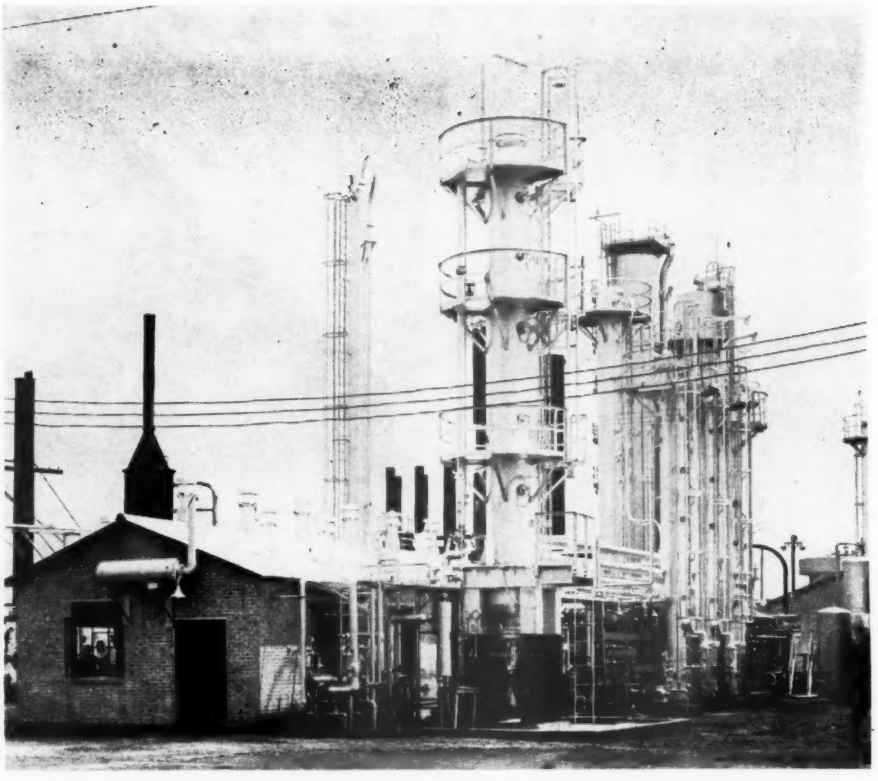
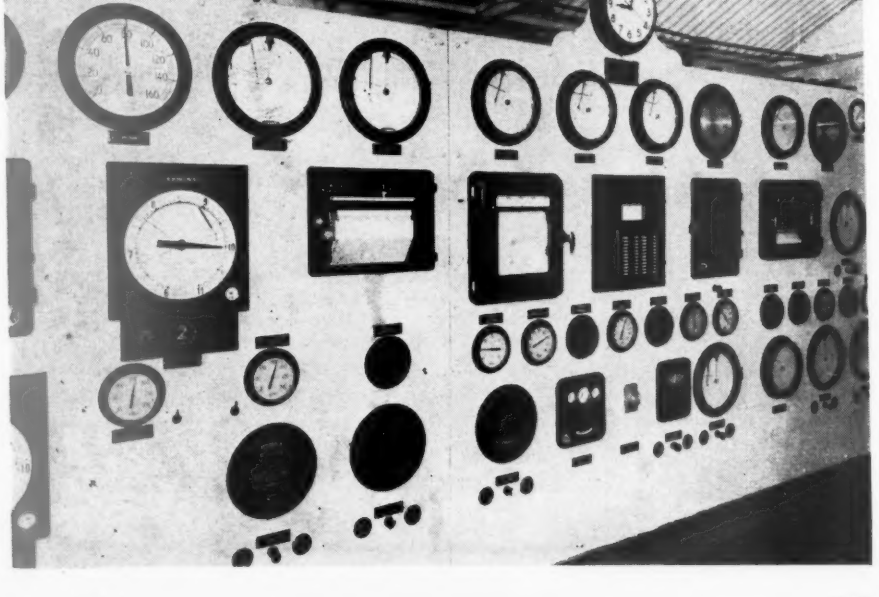


Southwest exposure of straight run stabilizer and polymerization unit.

Catalytic Polymerization New McMurrey Unit

By O. C. DeLOACH, Refinery Superintendent, McMurrey Refining Company



Instrument control board thermal cracking unit and crude processing.

▸ **Abstract.** *Addition of 150 barrels per day of premium motor fuel to the plant's production, representing an 8 per cent increase in gasoline yield, is the result of adding a catalytic polymerization unit, chamber type, to the plant of McMurrey Refining Company, at Tyler, Texas. The product has 82.5 ASTM Octane Number, 100 blending octane number, 1.2 mg. of ASTM gum. A new crude heater is being installed, a catalytic cracking unit is under consideration.*

A UOP catalytic polymerization unit which was placed in operation in the plant of the McMurrey Refining Company, Tyler, Texas, on May 11, 1948, is the latest step to be completed

in a program of expansion and improvement which began soon after the refinery was built in 1931, and is still in progress.

The poly unit is of the chamber type with a single tower and multiple catalyst beds; was designed by Universal engineers and built by McMurrey's own construction department.

Charge stock to the poly unit is the net stabilizer gas from the UOP thermal cracking unit. Its composition and that of the polymer product leaving the poly plant are shown in the following table:

	Fresh feed gas, mol. per cent	Polymer gasoline liquid per cent
Hydrogen		
Methane	1.8	
Ethylene	1.8	
Ethane	7.6	
Propylene	14.1	
Propane	24.5	
Isobutane	3.5	0.4
Isobutylene	7.2	0.1
n-butylene	15.2	2.5
Normal butane	22.4	13.9
Pentanes	1.9	9.2
Hexanes plus		73.9
	100.0	100.0
Specific gravity of hexanes plus		0.7316
Properties of polymer gasoline		
End point, °F		396
RVP, pounds		12.3
Specific gravity		0.7082

The poly unit has been in continuous operation since it was placed on stream, producing approximately 150 bbl of polymer per day, which represents about 4 per cent on the topped crude charged to the cracking unit and an 8 per cent increase in gasoline yield.

Not only is the overall production of gasoline thus increased, but the addition of the high octane polymer to the motor fuel considerably reduces the amount of tetraethyl lead required to maintain the McMurrey octane standard at 80 ASTM and 88 Research for premium gasoline, thereby affecting substantial savings. The polymer has an 82.5 ASTM octane rating and 100 ASTM blending value. Up to August 15, the yield of polymer had been 66 gal per lb of catalyst and the condition of the catalyst at that time was such as to indicate considerably longer effective life. Olefin conversion rate is about 90 per cent.

A number of catalytic polymerization units have been installed in various refineries since the war to process gases from catalytic cracking units. Many of these have been built by the adaptation of existing equipment.

By contrast, this unit, designed to polymerize thermally cracked gases, has been built with all new material from the ground up, in accordance with the McMurrey policy.

In operation, the gas from the cracking plant stabilizer is caustic washed and water washed. It is then picked up by a compressor and passes through the catalyst tower after ex-

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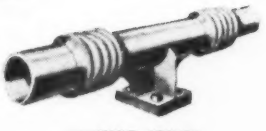

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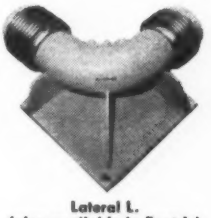

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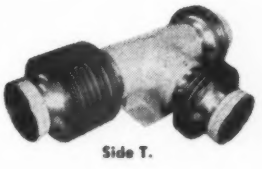
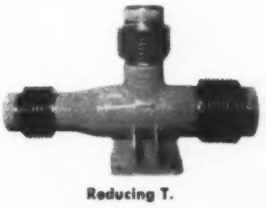
(also available in Foot L.)



Side T.



Reducing T.

changing heat with the catalyst tower effluent and being further heated to reaction temperature by means of a hot oil exchanger. Liquid butane is employed as a quench for catalyst temperature control. The catalyst tower effluent is fractionated to produce a stabilized polymer and a butane fraction which is used in the gasoline bends for vapor pressure control.

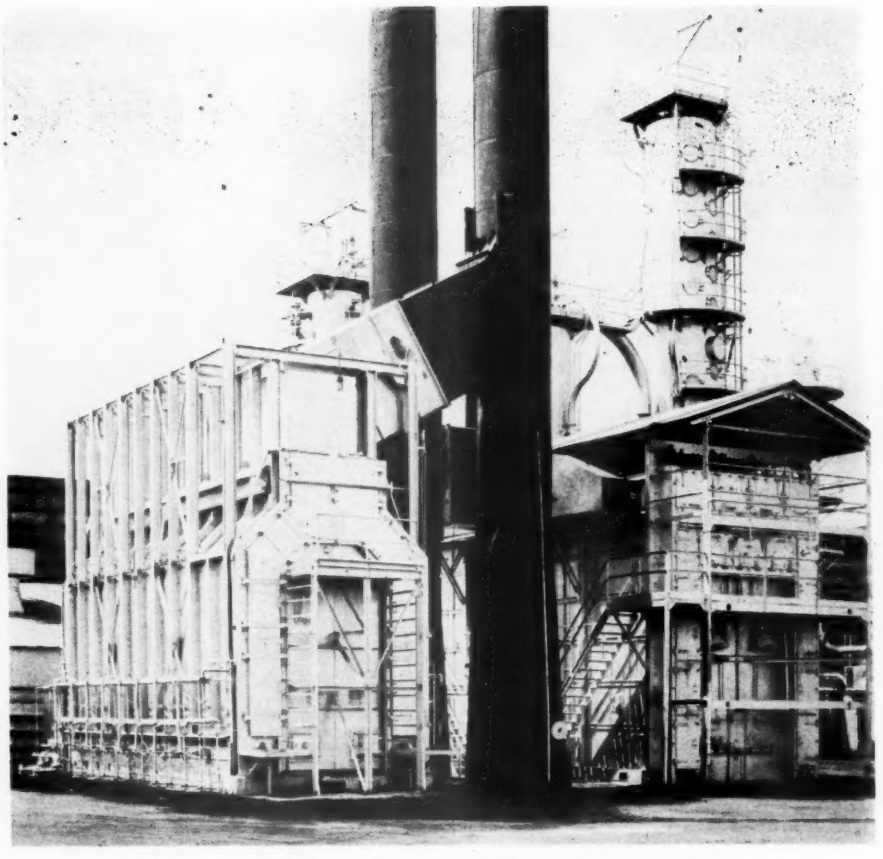
Average operating conditions for the poly unit are shown below:

Catalyst temperatures	
No. 1 bed—avg. F	400
No. 2 bed—avg. F	405
No. 3 bed—avg. F	410
Catalyst tower pressure	450 psi
Polymer production	150 B/D average ava.
Yield of polymer	
Volume per cent on topped crude	4.0
Olefin contents—Mol. per cent	
Fresh	34
Combined feed	22
Butane and lighter effluent	5
Polymer inspection	
RVP, pounds	12.0
API gravity, degrees	68.0
ASTM distillation	
IBP	95
10 per cent	160
50 per cent	230
70 per cent	260
90 per cent	360
E. P.	400
ASTM gum mgs/100 ml	1.2
ASTM octane number	82.5

M. H. McMurrey is president of the company. A. D. Blackwell is vice president, with A. M. Dullnig, vice president and treasurer. F. R. Faris is sales manager, C. M. Bryson, manager of the crude oil purchasing department, and C. T. Blackwell, pipe line superintendent. The writer is secretary of the company as well as refinery superintendent.

Originally the McMurrey refinery was a skimming and vis-breaking operation only, with a charge capacity of 12,000 bbl per day of East Texas crude. The products were straight-run gasoline, kerosine, and fuel oil.

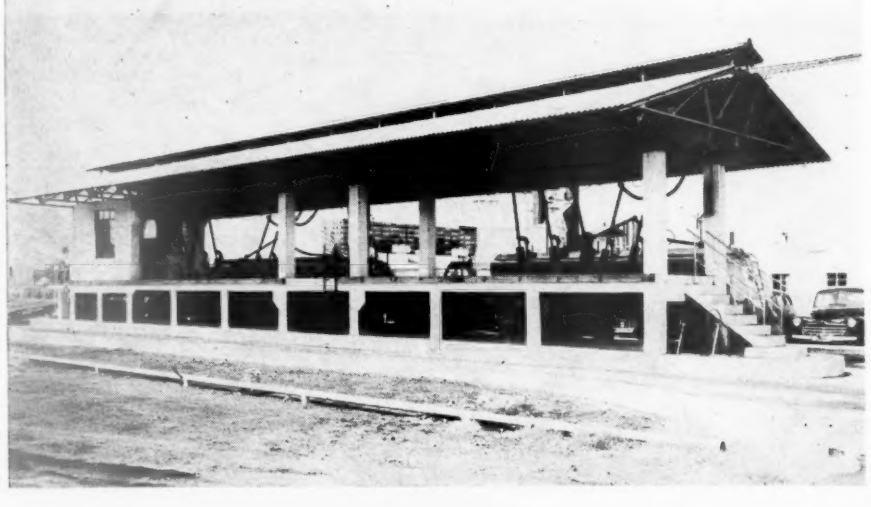
Two years later, a thermal cracking unit, with a design capacity of 1500 bbl per day of gas oil was built.



Heavy and light oil heaters on thermal cracking unit.

In 1937, using all new material, the refinery was completely rebuilt and modernized by Universal engineering and designing. At that time a UOP two-coil selective cracking unit was installed, which was able to crack 3750 bbl per day of a wide variety of charging stocks. This cracking unit has been in operation ever since: August 15 was the 142nd day of its present run.

Four transport truck loading dock.



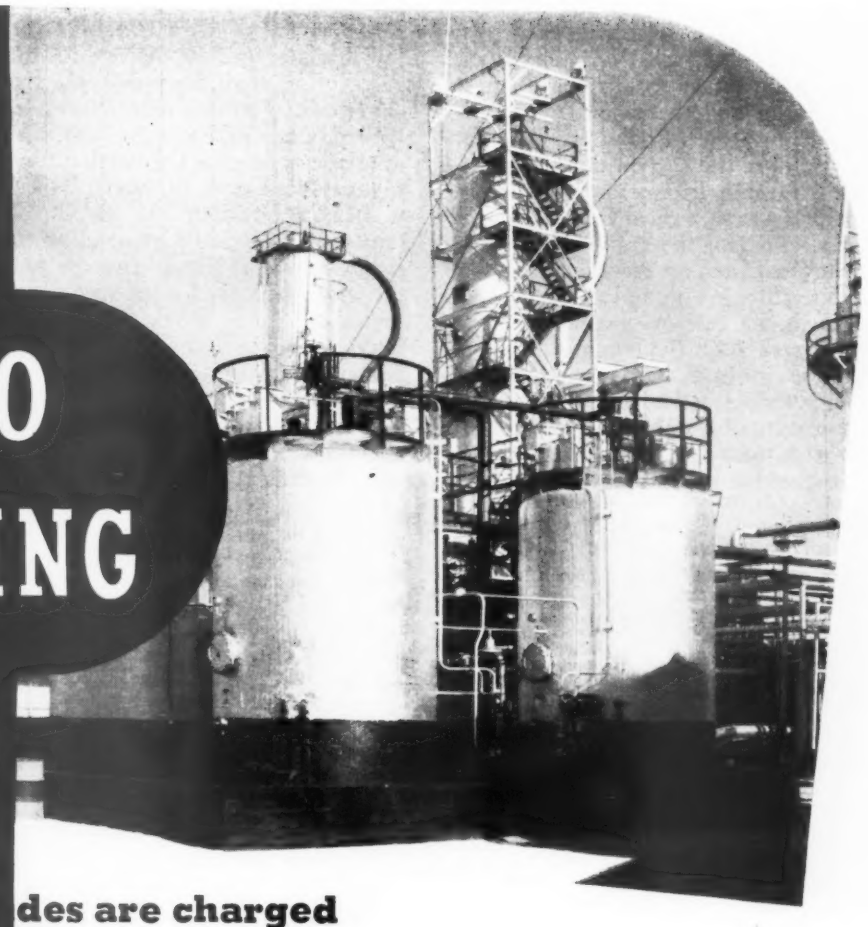
The refinery still operates on East Texas crude, which is gathered and delivered to the plant by the company's own pipeline system. The products now being made in addition to gasoline are naphtha, kerosine, Diesel fuel and No. 6 fuel oil. These are marketed chiefly by tank car and transport truck. In order to facilitate the movement of products, the company has installed a loading rack to accommodate 60 tank cars adjacent to to plant. The transport truck dock, where four big trucks can be loaded at the same time, is regarded as one of the most modern in the United States.

Major improvements during the 17-year history of the McMurrey company include the latest type of instrumentation, automatic controls, laboratory equipment, etc. One tetraethyl lead blending plant for motor gasoline was installed in 1939, and another for aviation gasoline in 1944.

The latest completed addition is the installation of the poly unit, but new chapters currently are being written by the construction of a new crude heater with capacity of 10,000 bbl per day, and the installation of two new boilers of 250 hp each. Consideration is being given to the installation of the latest type catalytic cracking unit.

* * *

PETRECO DESALTING



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PETRECO

SPECIALIZED *Electric* PETROLEUM PROCESSES { DESALTING DEHYDRATING

PR 47-N

Continued from Page 284

noted that there are two furnaces. One is used in the production of pure hydrogen and the other is used for producing $CO:H_2$ mixtures. In order to produce the carbon dioxide necessary for use in the second furnace, natural gas is burned in an inert gas generator and the carbon dioxide is recovered from the resulting flue gases by scrubbing with amine solution, although the carbon dioxide could be recovered from the flue gas from the furnace itself. The absorber shown on the left side of the bank of towers in the center of the picture is for carbon dioxide recovery. The other towers are the normal carbon dioxide absorbers and reactivator in the Hygirtol plant.

In this plant $CO:H_2$ ratios as high as 10 to 1 have been produced, so that it is capable of making any desired mixture of hydrogen and carbon monoxide from pure hydrogen down to a gas containing less than 10 per cent hydrogen and the balance carbon monoxide. By proper control of the ratios of reactants and the operating conditions in the furnace, very accurate control of the $CO:H_2$ ratio is easily attainable.

While the principal object of the Fischer-Tropsch type of plant is to produce liquid fuels, principally gasoline, from $CO:H_2$ mixtures, a considerable quantity of coproducts, mainly ethanol, propanol, butanol, acetic acid, propionic acid, acetone, methyl ethyl ketone, and acetaldehyde will be produced, also. These are only the more important organic chemicals that will be available from this source, and it is expected that a number of more complex organic acids, alcohols and ketones will also be available, but in smaller quantities.

An entirely different use for $CO:H_2$ mixtures is in the reduction of various metal oxides and ores.

Utility sendout gas. Another field in which a great deal of interest is being manifested at the present time is in the production of gas mixtures suitable for use in supplementing manufactured gas such as coke oven gas or carbureted water-gas for distribution through utility company mains.

The hydrocarbon-steam reaction has been found quite adaptable for the production of gas mixtures used for making blends equivalent to usual types of manufactured gas. The reformer furnace gas will have a very low specific gravity and a heating value of approximately 300 BTU per cubic foot. This can then be blended with propane or butane or other hydrocarbons to raise the heating value to the desired level. In some instances, a suitable blending gas can be obtained by replacing part or all of the steam in the reformer furnace with air which will yield a product gas of somewhat lower BTU content and higher specific gravity than is obtained with steam.

In the following table are indicated some typical fuel gas mixtures obtainable by blending steam-hydrocarbon furnace effluent gases with propane:

Blend	Mol. per cent					Specific gravity	GHV Btu–SCF
	H_2	CO	CO_2	N_2	C_3H_8		
1. Propane cracked with steam	72.5	19.2	8.3	....	....	0.36	298
2. No. 1 blended with propane	64.9	17.2	7.4	....	10.5	0.49	540
3. Propane cracked with air	31.0	22.2	1.0	45.8	....	0.70	173
4. No. 3 blended with propane	26.4	18.8	0.8	39.0	15.0	0.83	540

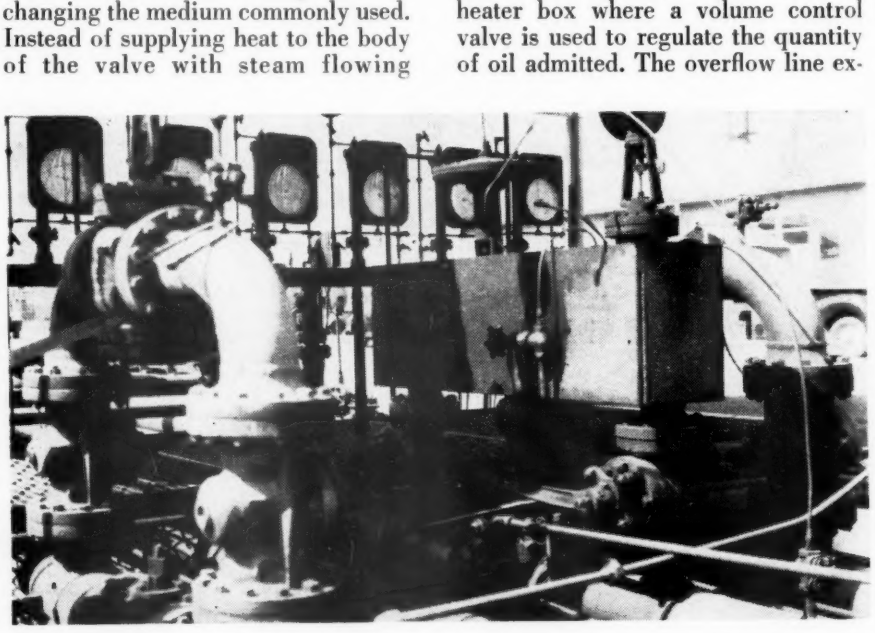
By various adjustments of the hydrocarbon-steam-air feed to the cracking furnace and by blending in various quantities of propane or butane, a fuel gas of almost any desired combination of gross heating value and specific gravity may be produced. Several installations of this type are already in use or under construction on the Eastern Seaboard.

The foregoing discussion has been presented in order to review the present-day status of the manufacture of hydrogen and mixtures of hydrogen and other gases for various purposes, from natural gas, light hydrocarbons and steam. Although the process was originally applied in the petroleum industry, it has now found numerous applications, both on a large and small scale, in several branches in the chemical industry and in the food industry, still using, however, raw materials derived from petroleum or natural gas.

* * *

HEATER BOX FOR CONTROL VALVE

Solving the problem of supplying heat to valves controlling the flow of gas, vapors or liquids containing hydrates, which cause ice to form in the orifice has been accomplished by changing the medium commonly used. Instead of supplying heat to the body of the valve with steam flowing through a copper pipe, or with hot water flowing into a frost box, a stream of hot oil will supply adequate heating with the advantage that it will not freeze when the flow is shut off, accidentally or otherwise.



A box is made to fit the setting to be protected, covering part of the upstream piping, or the controller loop, and as much of the valve body and yoke as is necessary. To use lean absorption oil in a gasoline plant, a small line is laid from the still outlet to the heater box where a volume control valve is used to regulate the quantity of oil admitted. The overflow line extends through the floor of the box upward to the desired height to maintain a full level of hot oil. Waste oil flowing from the box is piped back to the plant, if the box is some distance away, where it discharges into the sump supplied to collect oil from pump packing glands and stuffing boxes.

Design and Operation of Leonard TCC Unit*

By GEORGE KELSO, C. C. PEAVY, G. D. MYERS, and A. W. HOGE,
Houdry Process Corporation

THE Leonard TCC unit, the first small-scale catalytic cracking unit to be installed since the war, was put on stream March 18, 1947. Considering the effective utilization of existing equipment, the costs of material and construction and the results of the first three months' operation, the plant is an outstanding demonstration of the feasibility of catalytic cracking for the small refiner.

● **Process design.** The plant was designed to process 4500 bbl per day of reduced Michigan crude from which a reactor charge of 3000 bbl per day would be derived. These rates were fixed by the capacity of existing auxiliary equipment, the use of which was paramount in all design considerations. The catalytic equipment was purposely oversized to permit a future reactor charge of approximately 6500 bbl per day when the crude throughput of the refinery is increased. For all practical purposes it may be considered that the catalytic reactor and regeneration kiln merely supplanted the reaction chamber of an existing thermal cracking unit. Through careful planning, the existing thermal cracking raw charge pump, heat exchangers, light and heavy oil cracking furnaces, flash chamber, fractionating tower, absorption column, and stabilizing column were all utilized in preparing the unit to function as a catalytic cracking plant.

The process flow for the catalytic section of the plant is shown schematically in Fig. 1. The reduced crude charge for the plant is picked up from storage tanks by the charge pump and after passing through conventional heat exchange equipment is partially vaporized in the former light and heavy oil cracking coils. When the first design studies were made it was found that the pressure drop through the heaters would be excessive. To overcome this condition, the tubes were rearranged so that each heater now has two parallel coils for the heating and partial vaporization of the charge. From the heaters the partially vaporized reduced crude enters the former thermal cracker flash chamber, which is now employed as a tar separator. From this vessel, which operates at a temperature of 825 F and a pressure of 7 psig, 70 to 80 per cent of the reduced crude is flashed overhead as reactor charge. The bottoms from the tar separator are used in heavy fuel oil blends or charged to a vacuum tower for the production of asphalt. Steam, employed in the tar separator to assist in the vaporization of the reduced crude or charged to the reactor vapor inlet line, is superheated in separate coils placed in the convection section of each heater. The steam is superheated to a temperature of approximately 900 F and the quantity amounts to about 3100 lb per hr or 8 per cent by weight of the reactor charge.

The oil vapors from the tar separator enter the top of the cracking reactor where they come in contact with regenerated catalyst. The catalyst and oil vapors flow concurrently downward through the reactor and are withdrawn from the bottom of the vessel as separate streams; the catalyst passes to the elevator for return to the regenerating kiln while the oil vapors are directed to the fractionation system.

In catalytic cracking operations the total hydrocarbon stream leaving the cracking reactor is commonly called "synthetic crude". On the Leonard unit these vapors are fractionated into gasoline and gas, distillate fuel oil and heavy gas oil in a bubble tower formerly used in the thermal cracking unit. The overhead from the tower is cooled and partially condensed in a barometric-type, direct contact condenser from which unstabilized gasoline and rich gas are withdrawn. The latter is compressed to 75 psig in two 2-stage, 225-hp gas compressors, cooled and contacted with the unstabilized gasoline. This processing scheme was adopted in order to utilize to the best advantage the existing gas plant recovery equipment. The gas from this operation enters a 16-plate absorption column for which the supply of lean oil is a portion of the distillate fuel oil fraction drawn from the synthetic crude fractionating tower. The rich oil from the absorber is returned to the synthetic crude tower and serves as an intermediate reflux, while the dry gas from the absorption column enters the refinery fuel system. The gasoline from the contactor cooler is pumped to a 24-plate stabilizer where its vapor pressure is adjusted to approximately 10 psi. The overhead from the stabilizing column is sent to a depropanizer where it is separated into a C_4 fraction as bottoms and C_3 and lighter hydrocarbons as overhead. The latter stream is then fractionated in a deethanizer for the production of a purified propane fraction sold as liquefied petroleum gas.

The continuous circulation of catalyst in the system is maintained by a single 153-ft high endless chain bucket-type elevator that transports both spent and regenerated catalyst from the bottom to the top of the structure. Each elevator bucket is divided into three compartments, the combined volume of the two outer compartments, which carry spent catalyst, being equal to the volume of the center compartment that carries regenerated catalyst. The elevator has a design capacity of 150 tons per hr, which provides for the circulation of 75 tons per hr of spent catalyst to the kiln and 75 tons per hr of regenerated catalyst to the reactor. At reactor charge rates in the neighborhood of 3000 bbl per day, the 75 tons per hr of catalyst circulation is equivalent to a volumetric catalyst to oil ratio of approximately 4.5 to 1, which is the volume of catalyst circulated per hour divided by the liquid volume of oil charged per hour to the reactor.

Regenerated catalyst flowing downward through the reactor accumulates a carbonaceous deposit in the reaction zone, which temporarily reduces its catalytic activity. Thus, the catalyst flowing out of the reaction zone is normally referred to as "spent", and must be regenerated to restore its activity. Spent catalyst flowing through a central outlet line from the bottom of the reactor is split into two streams, which enter the elevator casing through specially designed control valves known as "chopper" valves. The divided stream of spent catalyst is directed into the two outer compartments of each elevator bucket and carried to the top of the structure where it is discharged into chutes leading into a hopper above the regenerating kiln. From the kiln hopper the catalyst flows downward through a circular distributing device into the kiln proper where the carbonaceous deposit or coke is removed by controlled combustion with air. The catalyst is regenerated in seven alternate burning and cooling zones and the excess heat of combustion is removed by the generation of 290 psi steam. Boiler feed water is continuously circulated through coils placed between burning zones and returned to a steam flash drum. As the rate of water circulation is several times that of the steam production the degree of vaporization occurring in the coils is sufficiently small to prevent the deposition of boiler scale. Regenerated catalyst flows from the bottom of the kiln in a central outlet line through another chopper valve into the center compartments of the elevator buckets, which carry it to the top of the structure where it is directed into the reactor hopper to repeat the cycle of flow through the system.

The catalyst circulation rate may be varied by adjusting the position of the

*Presented before Western Petroleum Refiners Association, Regional Meeting, Alma, Michigan, July 16, 1947.

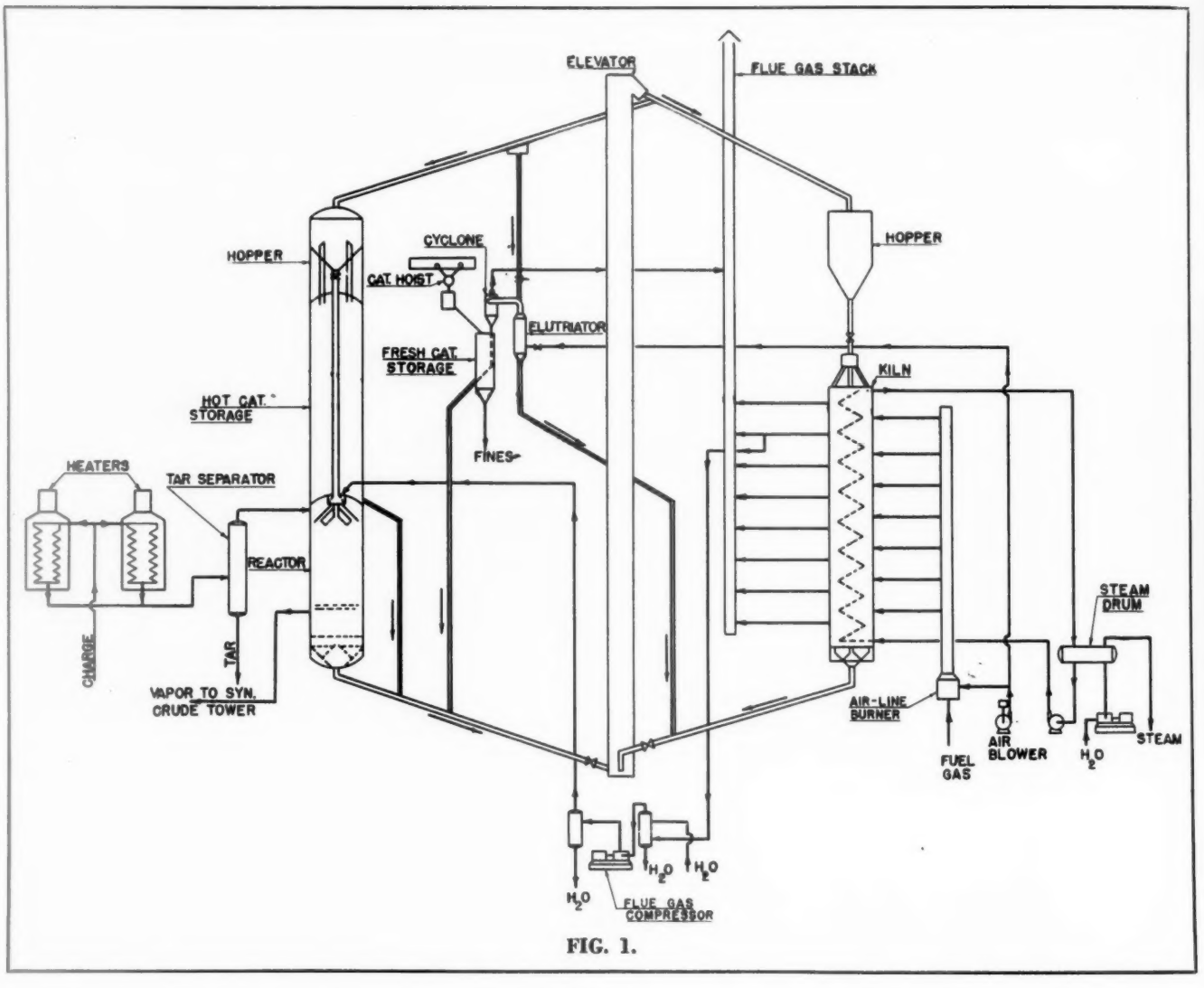


FIG. 1.

chopper valve in the kiln outlet line. When a change in catalyst flow rate out of the kiln is made in this manner, the flow of catalyst out of the bottom of the reactor is automatically adjusted to an equivalent rate by means of a level-indicator-controller in the reactor hopper, which actuates the chopper valves in the reactor catalyst outlet line.

● **Improvements incorporated in Leonard TCC unit design.** Several innovations have been made in the design of the Leonard TCC plant not only to reduce investment costs but also to improve the performance of the unit. The overall height of the catalytic section has been reduced about 50 ft below that of older TCC installations. Also, the catalytic section occupies only about 1250 sq ft of ground area and therefore was conveniently erected at the site of the former thermal cracker without changing the location of any existing equipment.

The reactor catalyst hopper, the hot catalyst storage bin, and the reactor are parts of a single, self-supporting cylindrical vessel. The hopper, occupying the top portion of the vessel, is connected to the reactor proper, which occupies the lower portion of the vessel, with a 45-ft long catalyst seal leg and the intermediate space surrounding the seal leg is utilized as the hot catalyst storage bin.

The 12-ft diam reactor is designed especially for concurrent flow of oil and catalyst, a development proved in several operating units. With this type of flow both the catalyst and oil vapors are introduced at the top of the reactor and pass downward through the reactor. The vapors are disengaged from the catalyst at the bottom of the reactor catalyst bed in a device designed to prevent the entrainment of particles of catalyst in the effluent vapor stream. The reactor is designed for a maximum catalyst bed depth of 15 ft and is arranged so that with only minor changes it may be adapted to mixed-phase operations wherein a portion of the reactor charge is injected as a liquid. Actually, a liquid injection nozzle is being designed and the charging of non-vaporizable material will begin very shortly. The liquid charge will be a cut from a vacuum tower fractionation of the tar separator bottoms.

The kiln is of the solid-bed type and is similar in basic design to that of larger TCC units but is reduced in height to conform to a lower carbon burning load. It consists of seven alternate burning and cooling zones in which the amount of air for combustion, as well as the number of cooling coils in use for removal of heat, may be varied in order to carry out the regeneration of the spent catalyst under the most favorable conditions. Further simplification in kiln design has been made in that the fresh air

TABLE 1. Summary of TCC unit time efficiency.
9:30 p. m. March 18, 1947, to 9:30 p. m. June 18, 1947.

Hours on stream	Off-stream time			On-stream efficiency
	Hours	Per cent of total	Reason	
	2.3	2.5	Catalyst circulation interrupted	
	16.7	18.1	Circulating water pump bearings replaced	
	25.3	27.4	Refinery power failures	
	48.0	52.0	Stabilizer cleaned	
Totals 2115.7	92.3	100.0		95.8 per cent

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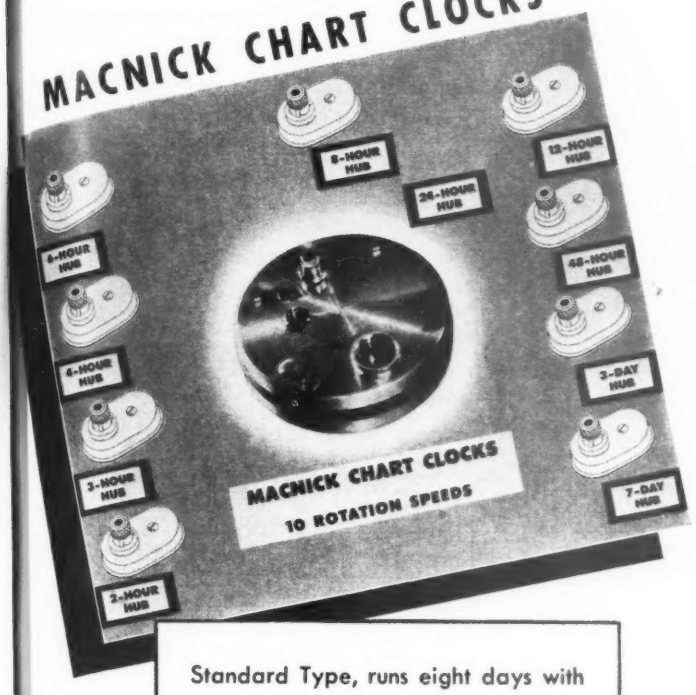

Standard Type, runs eight days with one winding, chart arbor turning once in 24 hours. Converter gears illustrated permit chart rotation speed to be changed without removing clock.

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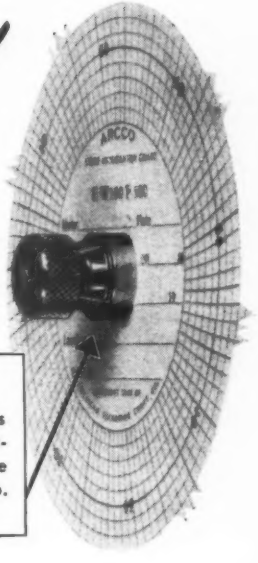
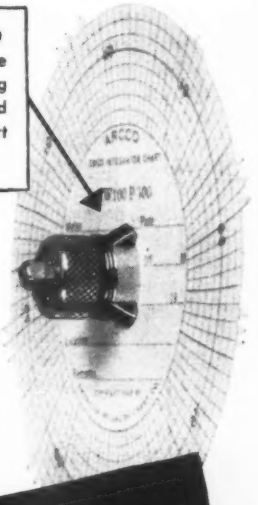


HUB OPEN
Gripping fingers retract permitting chart to be slipped over hub.



HUB CLOSED
Note how the three gripping fingers spread and lock the chart in place.

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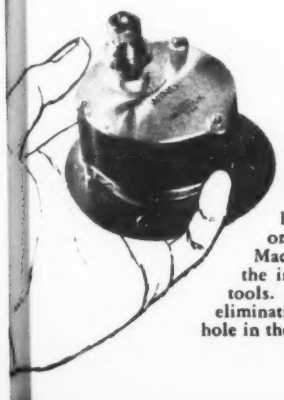

THE MACNICK *midget* CHART DRIVE

This clock fills the need for a small size drive in instruments where space is at a premium. It will run 48 hours on one winding. Chart hub turns once every 24 hours and may be either clockwise or counterclockwise rotation. The Macnick Midget snaps into position in the instrument case without the use of tools. It winds through the chart hub eliminating the need for a separate winding hole in the chart plate.

MACNICK DIVISION

ROCKWELL

for combustion and the outgoing flue gases enter and leave each zone on the same side of the kiln so that only one air inlet manifold and one flue gas outlet manifold are required

A newly designed catalyst distributing device is installed between the catalyst hopper and the kiln proper. Spent catalyst, introduced centrally into the distributor, flows into the first zone of the kiln through 16 catalyst feed pipes. The feed pipes are so designed that the upper ends, which are connected to the bottom head of the distributor, are arranged in a circular pattern, whereas the lower ends, which extend into the kiln, are arranged in a square-pitch pattern covering the entire cross-sectional area of the kiln. Such a device has been proved to contribute to uniformity in kiln operation by its control of particle size distribution in solid beds of catalyst.

On the Leonard TCC kiln the exhausting of the flue gases directly to the atmosphere from the main flue gas manifold has resulted in appreciable savings in equipment. In the TCC units erected during the war, cyclone separators were installed in the flue gas stack above the regenerating kiln as a precautionary measure in order to collect particles of catalyst that may have been carried out of the kiln by the outgoing flue gases. Experience has proved, however, that an insignificant amount of catalyst is lost in this manner and thus the need for cyclone separators in the outlet stack is obviated.

On former units the elutriator, which is the device used to maintain a satisfactory average catalyst particle size in the system by means of air classification, was also situated in the flue gas stack above the kiln in order to utilize the flue gas cyclones to collect the elutriated "fines." A small portion of the regenerated catalyst stream was continuously fed into the top of the elutriator and contacted in a countercurrent manner with a portion of the outgoing flue gases; the small catalyst particles were carried out of the elutriator into the cyclones by the flue gas stream while the large catalyst particles flowed by gravity into the center of the kiln hopper immediately below. As the cyclones have been proved unnecessary in the main flue gas outlet stream, however, the elutriator on the Leonard unit has been installed at a much lower elevation and made completely independent of the kiln system. A small stream of fresh air from the blower is the source of classification air and a single small cyclone separator mounted atop the elutriator is sufficient to collect all the "fines" produced. Also, the large particles of catalyst from the bottom of the elutriator flow into the kiln main outlet catalyst line. This modification has served to increase the kiln coke-burning capacity by eliminating the return of several tons per hour of regenerated catalyst to the kiln.

As previously indicated, the circulation of catalyst is accomplished with a single, split-bucket type elevator in contrast to the older TCC units, which were

TABLE 2. June 2 and 3, 1947.
Once through operation—product yields and inspections.

	ASTM distillation—°F									Octanes	
	BPSD	Vol %	°API	IBP	10%	50%	90%	EP	RVP	Wt % S.	CFR-M clear	CFR-R clear
Reed City reduced crude	3980		27.2	430	584	(32% at 670 F)						
Tar separator bottoms	895		19.4									
Reactor charge	3085	100.0	31.1	284	555	690	(72% at 711 F)			0.64		
Stabilized 400° EP motor gasoline	1450	47.1	62.5	90	110	202	374	400	9.3	0.046	78	89
Light catalytic gas oil	750	24.4	31.4	410	480	522	586	636		0.28		
Heavy catalytic gas oil	432	14.1	22.2	516	636	684	752	760+		0.93		
Excess C_4 fraction	328	10.6										
C_3 and lighter	9.9 wt %											
Carbon	9.9 wt %											

Principal operating conditions

Reactor		Kiln	
Tar separator overhead temperature	818 F	290 psi steam production	16,500 lb hr
Reactor caralyst inlet temperature	1050 F	Regeneration air rate	9,500 CFM
Catalyst/oil ratio, V/V	3.9		
Space velocity, V/hr/V	0.8		
Reactor inlet pressure	5 psig		

TABLE 3. May 6 and 7, 1947.
Recycling light catalytic gas oil—product yields and inspections.

	ASTM distillation—°F									CFR-M octanes	
	BPSD	Vol %	°API	IBP	10%	50%	90%	EP	RVP	Clear	+3cc
Reed City reduced crude	2961		27.6	270	(3.7% at 450 F)						
Recycle	1020		32.8	442	472	494	540	584			
Total heater charge	3981										
Tar separator bottoms	533		15.2								
Total reactor charge	3448		31.6								
Virgin reactor charge	2428	100.0		(5.0% at 450 F)							
Stabilized 400° EP motor gasoline	1325	54.5	61.8	88	112	224	390	408	9.3	77	85
Light catalytic gas oil	514	21.2	32.8	442	472	494	540	584			
Heavy catalytic gas oil	257	10.6	19.0								
Excess C_4 fraction	219	9.0									
C_3 and lighter	6.8 wt %										

Principal operating conditions

Reactor		Kiln	
Tar separator overhead temperature	820 F	290 psi steam production	15,000 lb/hr
Reactor catalyst inlet temperature	1010 F	Regeneration air rate	11,000 CFM
Recycle ratio, V/V	0.42		
Catalyst/oil ratio, V/V	2.8		
Space velocity, V/hr/V	0.9		
Reactor inlet pressure	5 psig		

TABLE 4. May 17, 18, 19, and 20, 1947.
Recycling heavy catalytic gas oil—product yields and inspections.

	ASTM distillation—°F									CFR-M octanes	
	BPSD	Vol %	°API	IBP	10%	50%	90%	EP	RVP	Clear	+3cc
Adams reduced crude	3959		20.4	267	(5.3% at 450 F)						
Heavy catalytic recycle	773		22.8	478	574	618	702	714			
Total heater charge	4632										
Tar separator bottoms	1843		11.0								
Total reactor charge	2789		30.0	(6.0% at 450 F)							
Virgin reactor charge	2016	100 0									
Stabilized 400° EP motor gasoline	1030	51.1	63.7	84	108	206	372	402	8.7	78	85
Light catalytic gas oil	494	24.5	31.6	358	460	480	524	560			
Heavy catalytic gas oil	204	10.1	22.8	478	574	618	702	714			
Excess C_4 fraction	167	8.3									
C_3 and lighter	6.2 wt %										

Principal operating conditions

Reactor		Kiln	
Tar separator overhead temperature	800 F	290-psi steam production	more than 20,000 lb/hr
Reactor catalyst inlet temperature	1020 F	Regeneration air rate	11,500 CFM
Recycle ratio, V/V	0.38		
Catalyst/oil ratio, V/V	3.6		
Space velocity, V/hr/V	0.7		
Reactor inlet pressure	4.4 psig		

equipped with separate elevators for the spent and regenerated catalyst streams. Several other improvements in elevator design have also been incorporated. For example, the entire elevator mechanism, including the cylindrical housing, is suspended from the top of the structure of the TCC unit proper, whereas in the older units the elevator load was carried by its own supporting framework. The insulation of the housing has been simplified by replacing the formerly used internal insulating panels with exterior insulation consisting of conventional, field-applied material. The pivoted or "walking" beam at the base of the ele-

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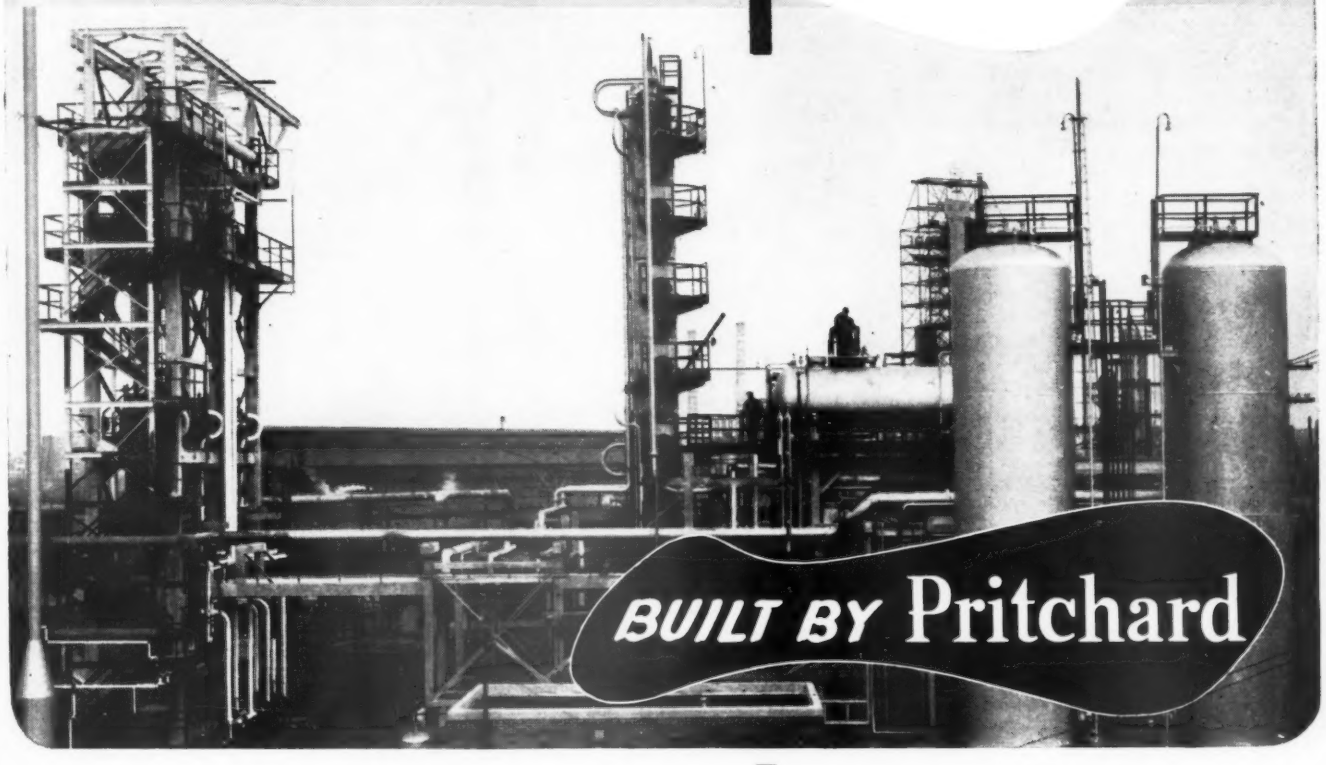

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vator in which the foot-shaft is mounted is also totally enclosed in the housing.

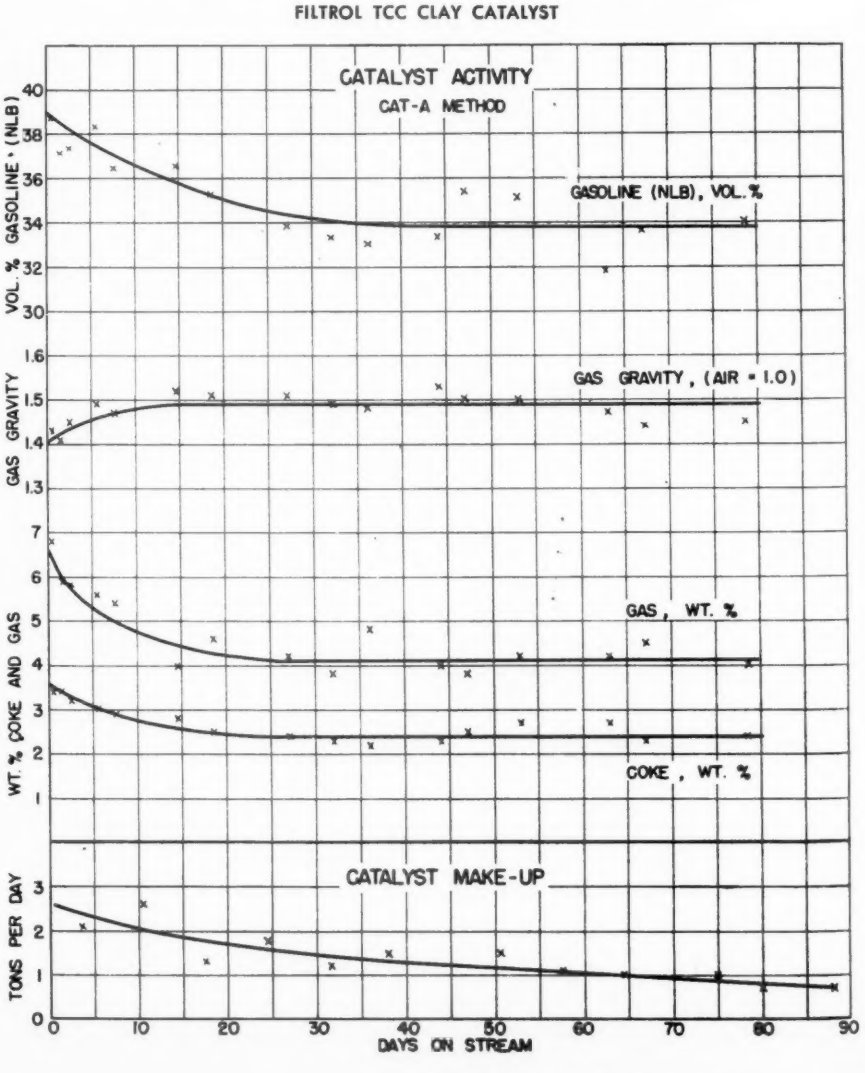
Another novel arrangement in the processing plan of the Leonard catalytic plant is the utilization of a barometric-type, direct-contact condenser in the synthetic crude tower overhead stream rather than shell and tube condensers that are usually employed in this service. The advantages of decreased pressure drop and low maintenance cost afforded by the barometric-type of condenser are noteworthy. For example, with a shell and tube condenser in use on the Leonard unit, the tar separator would have operated at approximately 10 psig in contrast to the 6 to 7 psig pressure resulting from the use of the barometric condenser. The lower tar separator pressure is of importance, for it permits the production of a greater percentage of tar separator overhead material or reactor charge at the same transfer line temperature. The synthetic crude tower overhead vapors enter the base of the barometric condenser wherein the heavier hydrocarbon components are condensed by a down-flowing stream of cooling water and pass into the gas and water separator tank on which the barometric is mounted. The non-condensable portion of the synthetic crude tower overhead stream passes up through the barometric and enters the top of the gas and water separator from which the gas compressors take suction. At the designed reactor charge rate and with a 75 F inlet water temperature, a cooling water supply of approximately 1250 gpm is required to condense and cool the synthetic crude tower overhead stream to 100 F. The rate of flow of effluent water from the separator tank is automatically regulated by a liquid level controller, which is sensitive to the location of the gasoline and water interface in the quiescent section of the separator.

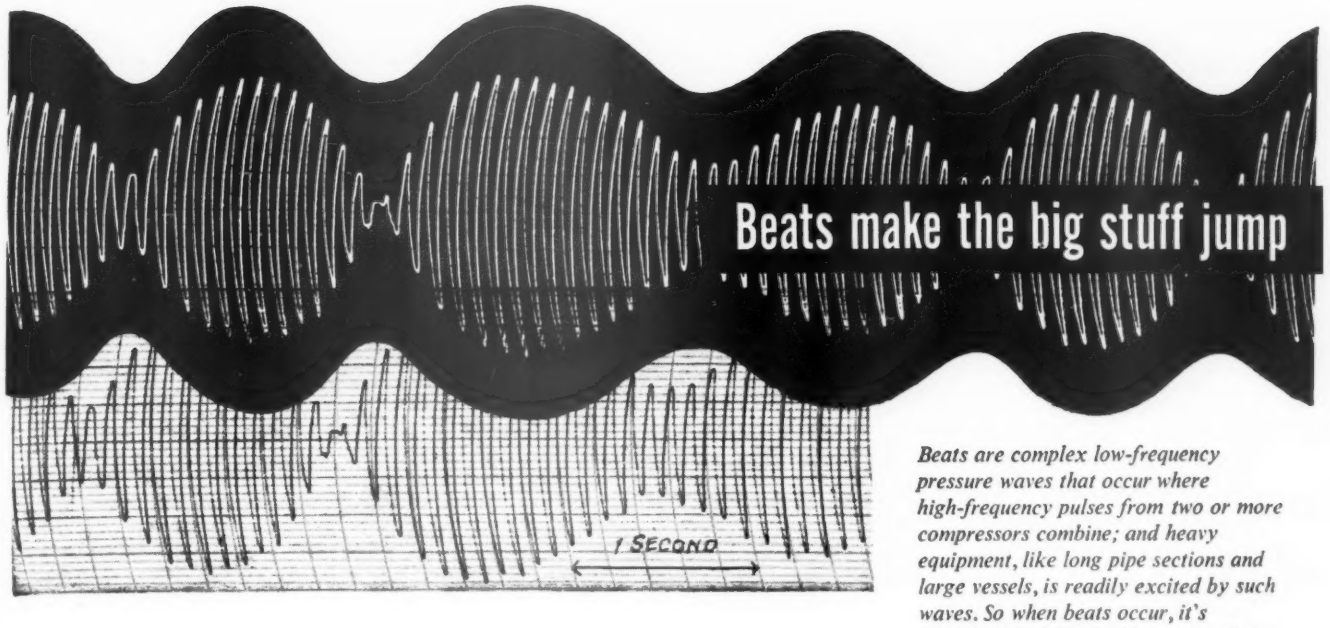
● **Operation of the unit.** During the first three months of operation of the unit, from March 18 to June 18, 1947, the plant had an on-stream efficiency of 95.8 per cent. Of the total down-time of 92.3 hr, only 19 hr were attributable to the catalytic section. Moreover, of the 19 hr only 2.3 were due to interruptions in catalyst flow, the remaining 16.7 hr having been consumed in replacing bearings in the kiln circulating water pump. On three occasions failure of the supply of electrical power to the refinery caused temporary off-stream periods amounting to a total of 25.3 hr. In all such instances, however, the unit was promptly put back into operation as soon as stable power supply was restored. Also, 48 hr of down-time occurred between May 28 and 30, 1947, when the unit was purposely taken off stream to clean the stabilizer column in the gas plant. At the conclusion of the operation of the thermal cracking unit the stabilizer column had been performing satisfactorily at a production of 800 bbl per day of thermal gasoline. Because of the desire to tie-in the catalytic equipment and resume operations as quickly as possible, it was decided to defer an inspection of the column to a later date; however, the performance of the stabilizer at the higher rates of catalytic gasoline production, i.e., 1300 to 1500 bbl per day, indicated a definite lack of fractionating efficiency due to the fouled condition of the trays. A summary of the time efficiency of the plant is given in Table 1.

In contrast to the constancy of the mechanical operation of the unit to date, a variety of charging stocks have been processed to fill the needs of the refinery. Although the unit was designed to process tar separator overhead material from reduced crude in a once through cracking operation, various deviations from the designed processing plan have been made. For example, straight run naphtha has been processed along with the tar separator overhead charge, both the light and heavy catalytic gas oil fractions have been recycled internally, and for several days whole crude was charged to the vaporizing heater. All these changes in charging stocks were made without interrupting the continuity of operation of the unit and demonstrate the extreme flexibility of the TCC process in this regard. The charging of whole crude to the TCC plant was a particularly advantageous procedure since it enabled the TCC unit to continue the production of marketable petroleum products during an emergency period when the crude unit in the refinery was forced off stream for repairs. Not only have many types of charging stock been processed in the TCC reactor but also the charging rates have been varied over a considerable range for experimental purposes to determine the flexibility of the unit. For example, the recovery section of the plant was revamped to handle a daily production of approximately 1300 bbl of 10-lb motor gasoline, but the production of specification gasoline has actually been as high as 1900 bbl per day.

In tables 2 through 4, summaries that are typical of the TCC unit operation on several of the charging stocks and processing schemes mentioned above are presented. These data were chosen at random from the daily log of the plant. Table 2 was prepared from the records of the operation on June 2 and 3, 1947, when the operating conditions and the charging stock were essentially equivalent to those for which the plant was

FIG. 2. Catalyst activity and makeup data versus days on stream.





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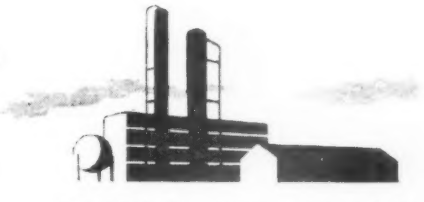

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designed. The 47 volume per cent yield of 10-lb motor gasoline having a clear CFR-M octane rating of 78 and a clear CFR-R rating of 89 is illustrative of a once through cracking operation on tar separator overhead from Michigan reduced crude. Actually, the octane ratings of the as-produced gasoline would have been higher had it been possible to exclude several per cent of straight run naphtha overlap from the charge to the reactor. Due to limited crude fractionating facilities in the Alma refinery, the reduced crude produced at current crude throughputs contains 3 to 4 volume per cent of naphtha boiling within the 400 F end point motor gasoline distillation range. This amount of overlap naphtha is equivalent to about 8 per cent of the total gasoline produced.

Table 3 is typical of the recycle operations wherein approximately 1000 bbl per day of light catalytic gas oil plus about 2400 bbl per day of virgin tar separator overhead comprised the total reactor charge. As indicated, the conversion and product yields based on fresh charge to the reactor were correspondingly higher than those from the once through operation although the actual rates of production in barrels per day were lower, indicating the refractory nature of the catalytic cycle stock. Here again the octane ratings of the as-produced gasoline were degraded by the presence of straight run naphtha.

Operations in which the heavy catalytic gas oil or synthetic crude tower bottoms fraction was recycled internally are illustrated by the summary given in Table 4. Although the recycling of this material is not generally advisable due to the high coke and low gasoline yields, at times it has been judicious to conduct such an operation in order to obtain products from the synthetic crude fractionating tower of certain boiling ranges. The most significant comment to be made about this operation is that, despite a sharp increase in coke production, there was no difficulty in continuing the smooth operation of the catalytic section or in removing the high coke deposit from the catalyst in the regenerating kiln. Incidentally, the recycling of catalytic gas oil or synthetic crude tower bottoms is an efficient means of augmenting the refinery steam supply. The production of steam in the TCC kiln from the combustion of the coke deposit is accomplished at practically 100 per cent heat utilization in contrast to a much lower fuel economy that would result from using the synthetic crude tower bottoms fraction as fuel in the refinery boiler plant.

During the period from April 22 to 25, 1947, raw, desalted Adams crude was charged to the vaporizing heater and flashed in the tar separator to produce a tar separator bottoms fraction of 10 to 11 deg API gravity. The overhead from the tar separator flash, which contained all the straight run gasoline, naphtha, and kerosine in the crude, was cracked in the reactor and processed in a conventional manner. A high yield of relatively low octane motor gasoline was produced due to the presence of the straight run gasoline in the charge. On the other hand, because of the desulphurization imparted to the straight run gasoline in the cracking operation, the lead susceptibility of the "as-produced" gasoline was very good, so that it was possible to prepare an acceptable gasoline product with the addition of 3cc TEL per gal. The tar separator bottoms production from this operation was subsequently processed to marketable asphalt.

One of the factors that has contributed greatly to the maintenance of excellent product distribution from the operation of the plant is the high level of catalyst activity that it has been possible to maintain with catalyst make-up rates of the order of one ton per day. This is particularly significant in the operation of small catalytic cracking units where an excessive catalyst consumption could be a large portion of the operating cost. Fig. 2 is a plot of the activity of the Filtrol natural clay catalyst in the system versus time and indicates that at the end of the first three months operation the catalyst in the system had an activity of 34 as measured by the CAT-A activity test. The very gradual decline in activity and the indicated equilibrium level of approximately 34 AI is shown by the graph. The graph also shows the daily catalyst make-up rates during the first three months of operation. Although the reactor charge rates have been consistently increased during this period, the consumption of catalyst has continuously decreased indicating that the catalyst make-up rate is independent of the reactor charge rate. It should be mentioned that no catalyst has been withdrawn from the unit and replaced with fresh catalyst for the purpose of maintaining or increasing the average catalyst activity. The catalyst make-up to date has been only that required to replace "fines" elutriated from the system and to compensate for normal catalyst shrinkage.

● **Construction of catalytic section.** A significant factor affecting the economics of catalytic cracking for the small refiner is the efficiency with which the catalytic cracking equipment can be built and tied in to existing refinery facilities. When construction costs are high due to labor inefficiency or to delay in delivery of materials, the conversion of the refinery to catalytic cracking operations becomes costly. Also, if existing refinery processing units, for example, a thermal cracking unit and recovery system, must be shut down for an extended period in order to tie in the catalytic equipment, the refiner stands to lose considerable revenue during the transition period.

The Houdry Process Corporation and its subsidiary, the Catalytic Construction Company, undertook the entire job of designing and constructing the catalytic section and revamping the feed preparation and recovery sections of the existing Leonard thermal cracking unit. The Catalytic Construction Company procured the material, erected the catalytic equipment, and revamped the existing facilities at the refinery. The first orders for material were placed in April, 1946, and actual construction work was begun on September 10, 1946. In less than five months the TCC unit proper was completed and another month was consumed in making the necessary revisions and tying in the existing auxiliary equipment. Despite adverse Michigan winter weather, the equipment was placed into full operation approximately six months after ground was broken and less than one year after the first order for material was placed. It is estimated that similar units could be constructed at a cost of $250 to $300 per daily bbl of reactor charge capacity.

In order to make such an enviable construction record, it was necessary for the Catalytic Construction organization to expedite very thoroughly the delivery of all materials and to prefabricate as many sections as possible to minimize the amount of work performed at the erection site. It is also interesting to note that, although the unit was constructed during a period of very unsettled labor conditions in the country, the entire job was completed without any loss of time due to labor disputes.

● **Operating personnel.** The initial operation of the Leonard TCC plant was supervised by a staff of operating engineers from the Technical Service and Plant Operations Division of the Houdry Process Corporation. Although the design of the plant incorporated improvements and simplifications developed from several years' operation of commercial TCC units, the success of the operation at Alma is due in a great measure to the competence of these men. The plant was put into operation during rigorous winter weather when the climatic conditions were the least favorable for starting up new equipment.

The story of the Leonard TCC unit would also be incomplete if due credit were not given to the operating personnel of the Leonard Refinery whose general operating ability enabled them to acquire the technique of handling TCC equipment with a minimum of training. The decision of the Leonard management to turn over the entire operation of the catalytic plant to their own personnel after only three months of experience is the best evidence of the ease with which the necessary operating skill was attained. Three men per shift operate the entire plant, i.e., the feed preparation, catalytic and gas plant sections.

● **Conclusion.** Notwithstanding the excellent service record of the unit, its demonstrated flexibility and the ease with which the necessary operating skill was attained, the real test of the unit is its ability to produce the yields and qualities of products set forth in the design of the plant. A test run was conducted on the Leonard TCC unit in which both the guaranteed yields and qualities were exceeded and on the basis of these results the plant was accepted by the Leonard management. ★★★

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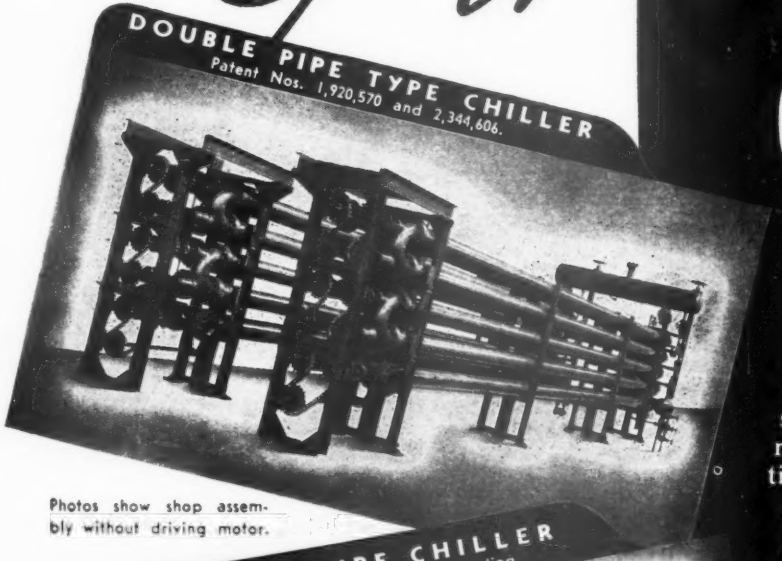

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PERSONALS

Harry W. Ferguson

HARRY W. FERGUSON, director of refining and sales for Humble Oil & Refining Company, has allowed the luxury of continuous and unremitting work at his job for nearly a quarter century to prevent him from becoming a real top-notch golfer, his friends say. Also, he is accused of going on hunting and fishing trips for the express purpose of being with a bunch of men with whom he likes to associate; he has been known even to hunt, or fish, on such occasions and with better than indifferent success, though it is difficult to induce him to tell "fish stories."

Ferguson became a refining executive in the most natural manner—started by taking a job in the refinery at Baytown in 1924, as chemical engineer, shortly after he received the chemical engineering degree from University of Michigan. Earlier, he had been born in Pennsylvania, attended Reading schools, and then Hotchkiss School in Connecticut two years. With little taste, apparently, for the routine operation of a plant unit, he became chief of cracking and technical service divisions of the development department, and eventually was transplanted to Houston as assistant manager of refining technical and research work. From then on even Ferguson could find no fault with the increasing speed with which problems, responsibilities and especially work were placed within his reach.

The refining manager needed an assistant with a self-starter, and picked on Ferguson, about 1937, which was merely his introduction to membership on the manufacturing committee, a mantle that fell on him later the same year. With a "tryout" as refining manager from 1941 to 1945, he was selected as a director and became head of the department. Not content with that broad job, he was presented two years later with the responsibility for the sales department, also.

These expanding duties gradually forced Harry to relinquish his activities in various directions, such as leading in Boy Scout work. The story of the salesman might well be told of him. Asked by a friend, after years of absence, for whom he was then working, this salesman reportedly replied, "Same crowd—wife and three children!" Daughter Jolyn, 19, and a Texas University sophomore, graduated head of the line among 500 Lamar High students; Son Keene, 14, Boy Scout and hunter-fisherman, who spent last vacation time on a guided tour of Canada, and Nancy, who boasts of 12 birthday anniversaries, a Girl Scout and photographer-in-the-making. These with petite Mrs. F., neé Josephine Linscott of Mobile, compose the Ferguson entourage.

▸ **Robert S. Aries,** president of R. S. Aries and Associates, consulting engineers and economists, and professor of Polytechnic Institute of Brooklyn, addressed the Société de Chimie Industrielle in Paris during August on the subject of "The American Petro-Chemical Industry and Its Relation to the European Chemical Industry." He gave another lecture to Federation de Chimie in Bruxelles, Belgium, on the same topic, in which he stressed the tremendous development of petroleum chemicals and predicted that Europe would soon follow the trend. Dr. Aries has just returned from a two-month's tour of Continental Europe and England, where his firm is engaged in the erection of a number of plants.

▸ **R. L. (Dick) Johnson** has been advanced to manager of Sunray Oil Corporation's catalytic cracking refinery at Duncan, Oklahoma, according to formal announcement to this effect here recently by **F. L. Martin,** executive vice president directing Sunray's refining division. Johnson had been superintendent of the Duncan plant since August, 1947, and succeeds **W. D. Manz,** resigned.

▸ **Arthur V. Danner,** formerly executive vice president and director of the Houdry Process Corporation, Philadelphia, has returned to the Socony-Vacuum Oil Company, it is announced by **Clark S. Teitsworth,** director in charge of manufacturing.

He will be in charge of process promotion for the company. Danner joined Socony-Vacuum in 1937 and during the war was on loan to the Petroleum Administration for War. He became associated with the Houdry corporation in 1944.

▸ **Warren A. Beman,** process products engineer for Socony-Vacuum Oil Company, Inc., in its industrial district at Albany, New York, has been transferred to the company's Chemical Products Division as staff engineer, at 26 Broadway, New York. Beman will be replaced by **G. H. Hocking** of the company's Philadelphia division.

Hocking has been a member of the Socony research and development department at Paulsboro, and in the technical service department at the Brooklyn laboratories.

▸ **Howard Montgomery,** terminals manager for Warren Petroleum Corp., at Houston, has been appointed chairman of the very important Technical Committee of the Natural Gasoline Association of America, C. R. Williams of the Chicago Corporation and president of the association announces. Joe F. Wood, of Skelly Oil Company, is vice-chairman of the committee.

Howard Montgomery

Among the various items on the agenda of the Committee for 1948-49 are included revision of the testing methods and specifications for liquefied petroleum gases, and a study of the field methods for determination of the individual hydrocarbon content of wet natural gas. Both projects will require a great deal of cooperative field work, as well as laboratory investigations, and are to be pushed to obtain revisions as soon as practicable.

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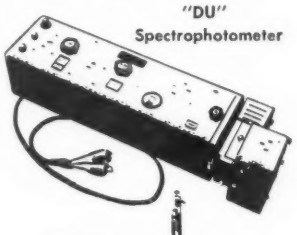

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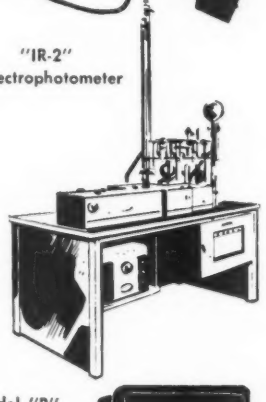

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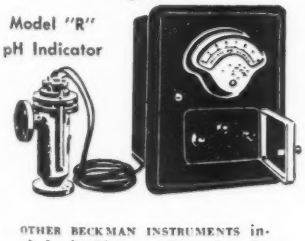

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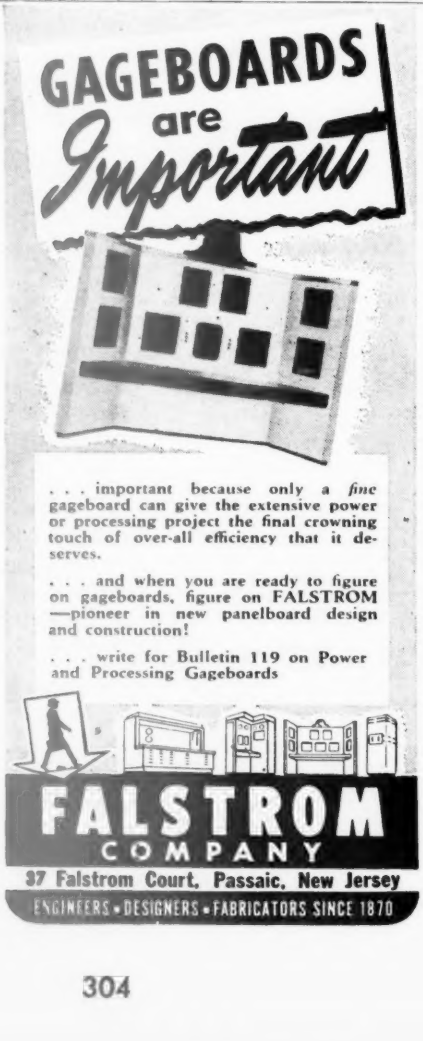
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▸ **David B. Burrows,** of Tulsa, has been appointed senior research engineer of Continental Oil Company's production research laboratory here, it was announced by W. C. MacMillan, vice president in charge of production and drilling.

David B. Burrows

Burrows, formerly a chemical engineer for an oil company in Tulsa, will be in charge of the fluid hydrocarbon section, which will make all analysis on bottom hole samples and condensate wells.

Born in Des Moines, Iowa, Burrows is a chemical engineering graduate of Oklahoma A. and M. College. He has been engaged for several years in reservoir engineering work.

▸ **Robert L. Sibley,** general manager of Monsanto Chemical Company's rubber service department at Nitro, West Virginia was granted the honorary degree of Doctor of Science from Clark University, Worcester, Massachusetts. Sibley has been with Monsanto since 1929, as patent lawyer and then research director, before taking his present position.

▸ **Don F. Gerstenberger,** well-known refining technologist and until recently general manager of the Inland Empire Refineries at Spokane, Washington, leaves shortly with a party of engineers as representative of Ralph M. Parsons Engineering Company, to study the Chinese oil industry. This will be carried out under sponsorship of the Economic Cooperative Administration. Gerstenberger and his corps of engineers will survey the activities of the Chinese Petroleum Corporation, in Taiwan (Formosa).

▸ **E. G. Bailey,** president of Babcock and Wilcox Company and national president of the American Society of Mechanical Engineers, spoke before the Mid-Continent section of that society in Tulsa recently. Bailey discussed at some length "The Engineer's Opportunities."

▸ **E. F. Semrad** has joined the staff of Ford, Bacon and Davis Engineering Company as engineer, in Kansas City. Semrad was formerly gas engineer in the Oklahoma City office of Cities Service Oil Company.

▸ **T. L. Tiernan,** has been promoted from assistant superintendent to manager of the Allen, Oklahoma, refinery of Sunray Oil Corporation, F. L. Martin, Sunray vice president of refining, announced. Tiernan succeeds **Dewey Vinson** who has been transferred to Sunray's Duncan plant.

▸ **E. J. Strawn,** Shell Oil Company, has been elected vice chairman of the Texas Section of the Society of Automotive Engineers. Strawn is regional superintendent of automotive equipment for Shell, and has been in that company's service for more than 25 years; he served as automotive superintendent at Tulsa before coming to Houston.

▸ **M. P. L. Love,** director of research at Shell Oil's Wood River, Illinois, refinery, has been named research department manager in the company's New York head office. In his new capacity, Love will coordinate and direct all manufacturing-research programs in the company's East-of-Rockies territory. **R. J. Greenshields,** chief engineer at the Wood River laboratories, will succeed Love as research director there.

▸ **Dr. Leslie C. Beard, Jr.,** Assistant Director of Laboratories, Socony-Vacuum Oil Company, Inc., has been elected a director of the American Society for Testing Materials for the 1948-51 term, the latest recognition of his long years of service in that body. Beard, born in Hagerstown, Maryland, was awarded the Ph.D. degree in chemistry by Johns Hopkins University, in 1922, taught chemistry there one year, and joined Standard Oil Company of New York in 1923 as research chemist.

Dr. L. C. Beard, Jr.

In 1930 he became Supervisor of Research and in 1933, Assistant Director of Socony's laboratories. He has been especially active in Committee D-2 on Petroleum Products and Lubricants, served on many subcommittees and has been chairman of several of these subcommittees. Since 1947 he has been a member of the Administrative Committee on Research, of the ASTM.

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Dr. C. R. Wagner, formerly chairman of the manufacturing committee of Pure Oil Company and consultant on refining technology and petroleum chemistry, was elevated recently from the position of vice president in charge of research for General Aniline and Film Corporation to that of vice president in charge of operations for that company. General Aniline is a large manufacturer and marketer of photographic and allied products, chemicals, and other products with several plants in different parts of the country. Wagner is widely known in the petroleum refining and petroleum chemical fields and for many years has been one of the leaders in the American Chemical Society.

Robert B. Cragin has been appointed vice president of Refinery Maintenance Company, Inc., of Compton, California, according to announcement by that company. "Bob" Cragin is well known in the refining and refinery engineering fields. He had extended experience with the M. W. Kellogg Company prior to World War II, was assistant chief of the refining division of the Petroleum Administration for War, and later was vice president of Houdry Process Corporation, with headquarters in New York City.

Robert B. Cragin

John E. Weber has been named manager of the planning department of the engineering division of Catalytic Construction Company, Philadelphia, Pennsylvania. Weber studied mechanical engineering at Pratt Institute, Brooklyn, and for nearly 20 years worked for The M. W. Kellogg Company where he rose to head of the piping department and assistant to the chief draftsman.

Between 1943 and 1946 he served as division engineer with the Kellex Corporation. In the following year, Weber was oil refinery engineer for Arthur G. McKee Company and in the year prior to joining Catalytic Construction Company, he was project engineer for Project Engineering Company of New York, New York.

Franklin Wedge, former eastern manager for Ansul Chemical Company, has been appointed assistant to the president. He has moved from Philadelphia to the company's main office at Marinette, Wisconsin. With this assignment, Wedge climaxes an 18-year career with Ansul. He is a member of the American Society of Refrigerating Engineers, and ACS.

Dr. Carl F. Prutton, formerly head of the department of Chemistry and of Chemical Engineering, Case School of Applied Science, Cleveland, Ohio, has been appointed director of research for Mathieson Chemical Corporation, with headquarters at the Mathieson offices in New York City and at the laboratories in Niagara Falls, New York, Thomas S. Nichols, Mathieson president, has announced.

Dr. Carl F. Prutton

Dr. Prutton has been associated with Case School for nearly 30 years, and has had wide experience as consultant and research chemist with industry. He graduated from Case with a bachelor's degree in science in 1920, and received the Ph.D. degree from Western Reserve University in 1928.

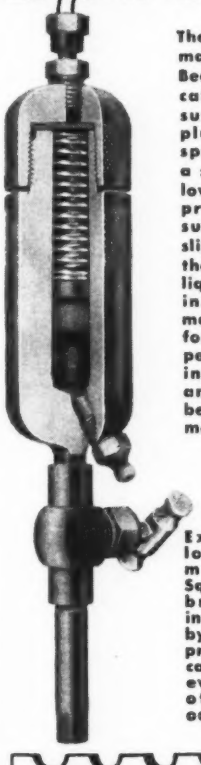
He served as consultant for Lubrizol Corporation from 1928 until joining Mathieson; also as consultant to the Dow Chemical Company from 1928 until 1941. During the war he headed the Process Development Branch of the Office of Rubber Director, and was a consultant for the War Production Board. He holds more than 100 industrial patents on chemicals and allied products; has written many papers on industrial chemistry, physics, especially in the fields of lubrication and corrosion, and is a member of the American Chemical Society, American Institute of Chemical Engineers, Society of Automotive Engineers, American Petroleum Institute, and other scientific and industrial organizations.

Robert H. Andrews has been appointed assistant to the president, General David N. Hauseman of Houdry Process Corporation of Philadelphia. Andrews will serve also as assistant secretary and assistant treasurer of the Corporation.

Robert H. Andrews

Andrews, born in Dallas, Texas, received an A.B. in accounting from Rice Institute, went to work for Humble Oil and Refining Company. He coordinated publication of that company's production department operating manual, used by the 52 district offices. He served five years in the armed forces ordnance department, retiring with the rank of colonel.

new lubricator whips orifice meter bearing-shaft problems



The new Squier Automatic Orifice Meter Bearing-Shaft Lubricator utilizes pressure in the meter, plus a light coiled spring connected to a steel piston and low-friction cup, to provide a positive sustained pressure slightly in excess of the measured gas or liquid pressure. This increased pressure makes it impossible for gas or liquid to penetrate the bearing-shaft housing and lock or freeze bearing parts during meter operation.

Exclusive spring-loaded type design makes the new Squier Automatic Lubricator the only instrument available by which continuous pressure-lubrication can be maintained, even though a shut-off or back flow occurs in the line.

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NEWS

Lion Oil to manufacture protective coatings

A new plant costing a quarter of a million dollars will be completed by December by Lion Oil Company near El Dorado, Arkansas, for the manufacture of protective coatings for all types of materials, T. M. Martin, Lion Oil president, has announced. Industrial rust-preventive compounds, and a line of products of this type approved by the Federal Government will be made. One section of the plant will make mastic-type coatings, sound deadeners for truck and car bodies. Car cements, insulating compounds and mastics for use in railroad equipment will be made in another section.

The new manager of the department is Ray D. Cunningham, recently director of sales for Nox-Rust Chemical Company of Chicago. One Lion Oil Company subsidiary has been operating an ammonia and ammonium nitrate plant for several years, synthesizing the ammonia from natural gas and air.

The other unit manufactures hexylene glycol, and is now in full-scale operation. Hexylene glycol is a colorless liquid, and is used widely as a solvent in hydraulic fluids, as an absorber of moisture—humectant—and as a type of emulsifier, or "coupling agent." As a coupling agent it makes possible the mixing of two liquids that otherwise do not mix or dissolve in each other.

Shell makes new heavy oil

New heavy-duty motor oil is announced by C. E. Davis, vice president of Shell Oil Company in charge of manufacturing, which has been designed and developed to reduce to a minimum the wear of the engine and the deterioration of the oil in service. This oil consists of a well refined petroleum oil as base stock, to which has been added a compounded agent named Perma-16, containing a detergent, an "anti-wear agent," and an anti-oxidant. It will be sold under the name of Shell's well-known brand "Shell X-100."

The oil is designed especially to meet the severe requirements of car engines operated in intermittent service as are the great majority of the motor cars of today. Under these conditions of cold operation, corrosive materials from combustion products, and water from various sources tend to corrode engine parts; other deleterious products are formed in the oil or from outside sources. The new oil has been tested in engines which ran 300,000 miles without overhaul. It has been tested also in 2,500,000 miles of road operation in gasoline and diesel engines, it is stated.

Nitrogen removal unit

Removal of nitrogen from natural gas, prior to forwarding it in pipe lines is being studied intensively, according to advices from American Gas Association and U. S. Bureau of Mines. A conference held in Amarillo recently discussed various methods for removal of the inert, useless gas, which is found in various fields in quantities up to 10-15 per cent, as in the Texas Panhandle and Hugoton, Kansas, fields, and up to 30 per cent or more in some production.

The Bureau of Mines has installed an experimental nitrogen removal pilot plant at its Exell Helium plant near Amarillo, and still employ methods similar to those used in extracting helium, it is understood. P. V. Mullins of the Bureau staff is in charge of this work under the direction of C. W. Seibel, supervising engineer of helium plants, and of R. A. Cattell, chief engineer of the Bureau's Petroleum and Natural Gas Divisions.

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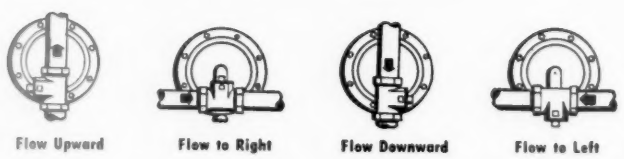

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NEWS

Liquid fuels from natural gas by electro-chemical process

Completion of a pilot plant for the development of a process for making liquid fuels by "an electrochemical process" has been announced by Dr. H. M. Unschuld, director of research for Electomic Chemical Corp. of Mt. Carmel, Illinois. The process is capable of producing four gallons of liquid hydrocarbons per 1000 cu ft of natural gas, Dr. Unschuld says, and the product "is 99 per cent pure." From the initial products many chemicals such as aldehydes, acids, alcohols, ketones, etc., can be made.

Dr. John Krawetz of Phoenix Chemical Laboratory, Chicago, says this appears to be a new departure in processes for producing liquid hydrocarbons from natural gas, report says. Chief financial interest in the process and in the pilot plant, which latter is said to have cost "several hundred thousand dollars," is reported to be held by James Graham, well known Chicago business man and president of Graham Plating works.

Fuels hearing postponed

Hearings before the National Resources Economic Committee, scheduled originally for October 5, 6, and 7 in Washington, D. C., have been postponed and will be held in Washington starting January 18, 1949, according to announcement by Senator George W. Malone, chairman of the NRE committee. The hearings are on the subject of the fuels position of the United States.

Phillips to make two fertilizers

Phillips Chemical Company has taken possession of Todd Shipyard property, a 338-acre tract on the Houston Ship Channel, and is in process of building a plant for the production of 266,000 tons of ammonium sulfate fertilizer per year. The name of this property has been changed to Port Adams, in honor of K. S. Adams, Phillips Petroleum Company president.

One unit of the fertilizer plant is expected to be running before December 1, 1948, and the second unit will be operating early in 1949. Chemical Construction Company is building the fertilizer plant proper while dock and marine work is in the hands of Brown & Root, Inc. The plant will employ more than 200 persons when in full operation; its entire output of sulphate has been contracted to the U. S. Army until June 30, 1949. Ammonia will be shipped to the plant from the Phillips synthetic ammonia plant at Etter, Texas, bought recently from WAA, and where another fertilizer, ammonium nitrate, is produced by Phillips Chemical, at the rate of 200 tons per day and which will be stepped up to 400 tons daily as soon as expansion plans now under way are completed. The Phillips company will use the dock and shipping facilities at Port Adams to handle its shipments of equipment, etc., to foreign destinations, especially South America.

Inspection manual out

Manual of Inspection Practices has been formulated by the American Petroleum Institute and is now ready for distribution, the Institute announces. The present edition is Part I of six parts to be published eventually, and is devoted to process equipment. The work on this manual was started in the 1930's, but was stopped during World War II, when a manual for the maintenance of defense plants was developed. "Part I—Process Equipment" may be obtained for $3 from API, 50 West 50th Street, New York.

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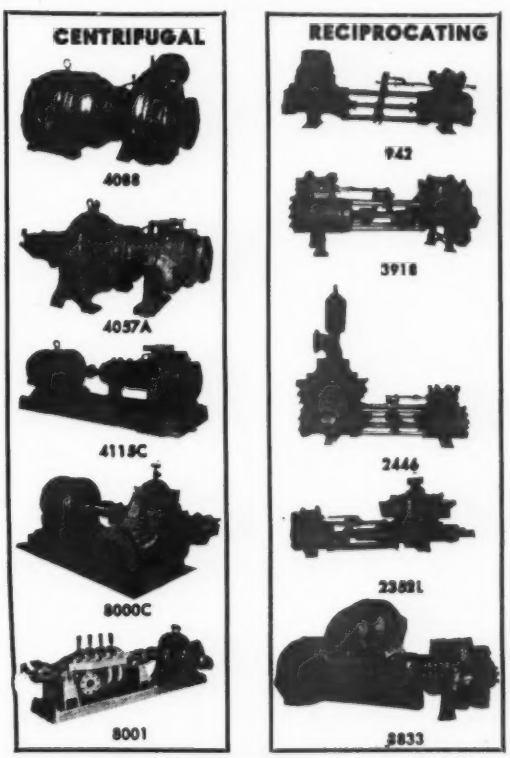

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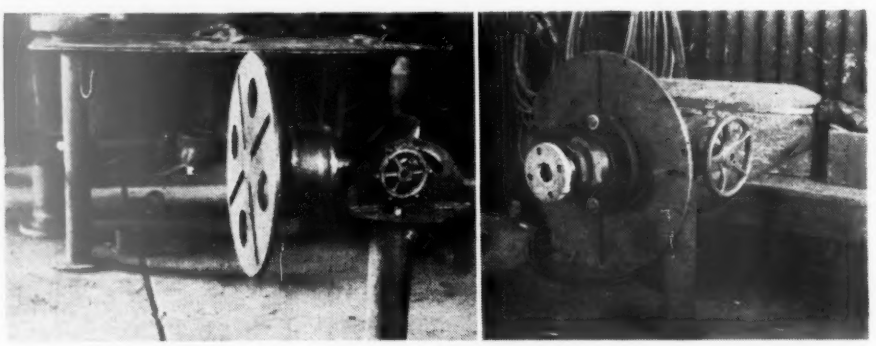
PLANT AIDS

Setting an emergency pump on foundation bolts equipped with two sets of nuts; one set below the base plate and the other set in the usual position above.

Leveling emergency pump

An emergency pump can be set quickly and used almost immediately when set on a concrete foundation without the use of leveling wedges. The foundation bolts are fitted with heavy nuts, run down upon the threads below the point where the base plate is to be leveled off. When the pump is set on the bolts, the weight of the unit is supported entirely by the nuts below the base plate. To level before pouring the concrete grout, two men use wrenches, one on each side, turning the supporting nuts up or down, as the case may be, to set the pump level. When that point has been reached, the top nuts are drawn down tightly and the grout poured of quick-set expanding cement. As the pump is supported firmly and rigidly upon the lower set of nuts, it can be placed in operation quickly without fear of leveling wedges slipping from beneath the base plate.



Adjustable welder stand

Convenient welder's adjustable stands to hold flanges and fittings when making up special connections in the shop are shown in the photos. These two stands have face plates attached to a shaft to permit rotation of the piece held in place with bolts while the welder lays on the bead. The table of the stand has a quadrant with a locking wheel so that the face plate and material being formed can be set at any angle through 90 degrees from horizontal to vertical. To obtain smooth rotation of the face plate and shaft, large ball bearing units are used. The bearing is pressed into a retainer, also made in the shop, so that the race is held stationary. The cone is pressed upon the shaft that supports the face plate so the work which the welder is doing can be easily turned, or rotated at will. The ball bearing is one which was discarded because of a chipped ball, or a worn race or cone, and is completely enclosed in the retainer for dust-proofing and to keep lubrication to a minimum. The face plate is slotted from the center to the rim for attaching flanges of various diameters.

How to space shaft hangers

To assist readers who may have shafting jobs to do here are two charts; the chart on the left is for shafting without pulleys as stated at the top, the other chart is for shafting with pulleys.

To use the chart, for example: Q. How far apart should hangers be spaced on 2-in. shafting, on which there will be no pulleys?

A. Find the 2, column A, and across in column B is the answer—practically 15 feet apart.

Again: Q. How far apart should the hangers be spaced where an average number of pulleys will be employed?

A. Find the 2 in column C this time and glance across to column D. The answer is—about 9 ft apart.

Where shafting is more heavily loaded than average the distance should be less than given in column D. That is where the buyer or installation man must apply directions given in installation handbooks, or use good judgment.

These charts cover shaft diameters from ¼ in. to 5 in. In practice shafts are seldom smaller or larger than those limits.

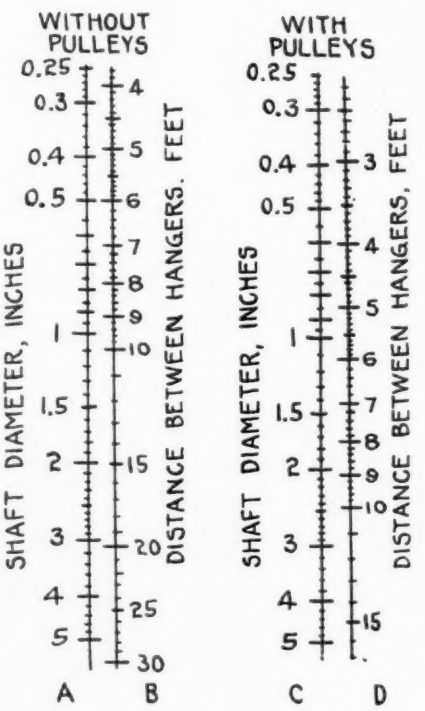
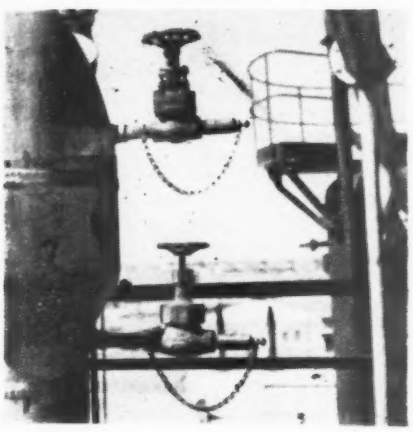


Chart for shafting without and with pulleys.

PLANT AIDS

Valve thread protectors

Tap valves, installed on vapor lines to obtain pressures with a portable gage, or to collect samples of gas or vapor for testing, are usually in the open air and are subject to various types of corrosion. Since one end of the valve body is frequently left open in a short time the threads will not



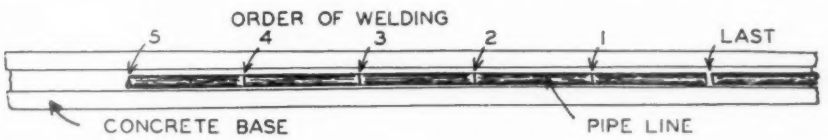
permit coupling of the test apparatus with a tight seal. To prevent corrosion and disintegration of the threads in the open end of the valve body, small bull plugs can be used advantageously. To prevent losing the plugs, a short chain is attached to the nipple behind the valve and to the end of the bull plug. As a swivel to permit the plug to turn freely while attached to the chain, the bull plug has a round head rivet welded in the closed end as a pin to which the end of the chain is attached. As the plug hangs freely on the end of the chain when removed from the valve body, it can easily be obtained and replaced.

How to "position" when welding pipe

Welding in modern manufacturing plants has brought about the creation of a new and valuable machine called the "positioner" by some and the "manipulator" by others. It is a sort of gigantic lathe face plate, adjustable to any angle, to which face plate the work is fastened. By means of this positioner the work is rotated around to any position most convenient to the welder. It is a time, energy, and back saver. In addition to saving considerable money it assures welding of higher quality.

In the welding of pipe joints the principles of the positioner can be advantageously copied as indicated in the accompanying sketch. The thing to do is to turn or "position" as much of the piping as possible when welding so that the work can be performed conveniently from above. Don't "get under" at every joint. Thus, let us say that you are welding from the right and toward the left. The piece of pipe at the extreme right is rigid and cannot be turned. Do not weld the joint marked "Last." Wait a while. First weld 1, then 2, then 3, 4, 5, etc., and "position" the work by turning the pipe. When you have handled as many joints in this manner as practicable, then weld the joint marked "Last."

Work of this kind is sometimes performed on a concrete base, as indicated, particularly in connection with central station heating jobs. Where pipe runs



are long and straight nearly all of the joints can be positioned in this manner; however, even where there is no concrete base and where grades are variable it is well worth while to bear this "positioning method" in mind. It is a great time, energy, back, and money saver.

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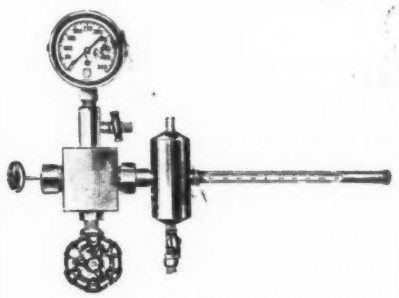

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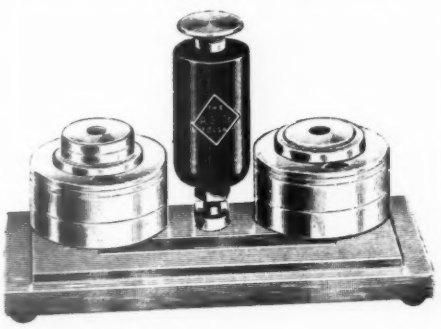

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NEWS

Uses Houdry method

New Houdriflow catalytic cracker being built by Sun Oil Company at its Toledo refinery is based on the older Houdry principle, but uses a pneumatic lift for circulating the catalyst through the system. It will charge 42,000 bbl of oil per day. All catalytic elements such as reactor and regenerator kiln are of the packaged type, built at the fabricator's plant as units and shipped to the site and erected as one unit. Catalytic Construction Corporation of Philadelphia will handle all matters pertaining to the cracker job, C. H. Thayer, refining vice president, announced. Other work includes a gas compression unit by Fluor Corporation; a gas absorption and stabilization unit by Process Engineers, Inc.; also a new polymerization plant, a crude distillation and a vacuum flash unit, steam unit, water supply, warehouse and maintenance shops, electric sub-station, storage and office facilities. Major construction is expected to be completed by the end of 1949, Thayer said.

Large storage capacity needed for LPG

Launching of an immediate programme for building large capacity for storing liquefied petroleum gases during periods of low consumption has been recommended to the petroleum industry by the National Petroleum Council's Committee on LPG in its July 29, 1948, report. This committee, headed by Chairman W. K. Warren, Warren Petroleum Corporation, finds that, insofar as its investigations have revealed the facts, sufficient LPG will be produced during 1948 and 1949 to meet the demands on the industry. Inability to obtain estimates from various refiners, large and small, which now produce or may provide capacity in the near future for producing considerable amounts of LPG make it impossible for the committee to give an iron-clad estimate of production for the immediate future.

Production and demand estimates for 1948 and 1949 by the committee are as follows;

	1948	1949
Annual production rate, end of year, gal.	3,263,881,600	3,771,886,600
Annual demand,	3,194,102,000	3,755,220,000
Annual surplus	69,780,000	16,667,000
Indicated daily average surplus, at end of year	193,800	46,100

The committee emphasized that while the annual production appears to be sufficient to meet all demands as estimated, the production at any given time of maximum demand may not be adequate to supply the requirements from current production. Therefore the production during slack times, sufficient to meet the peak demands, must either be lost irretrievably or must be stored against the time when it is needed. This storage capacity is not now available.

Production estimates include new capacity under construction and planned, of 1,112,847,000 gal of propane, butane and LPG per year while two plants now building, in Pennsylvania and in California, did not report capacities which will increase this total figure. Estimates are that 60 per cent of this new capacity will be installed during 1948. Of the total production the estimate shows that refineries will produce 839,198,600 gal in 1948, and 903,070,600 gal in 1949; the remainder will be produced from other sources.

Demand estimates include a consumption in 1948 for chemicals of 556,100,000 gal; in 1949, 695,100,000 gal. Domestic demand is forecast as being 1,300,000,000 gal for 1948, 1,560,000,000 gal for 1949. Synthetic rubber is estimated for each year to require 350,000,000 gal annually. Prospective consumers are urged to complete definite contracts with suppliers for their entire needs before installing new LPG consuming facilities.

Globe to install fluid cat cracker

Globe Oil and Refining Company has made agreement with Universal Oil Products Co., of Chicago, for the installation of a Fluid catalytic cracking unit at Globe's Lemont, Illinois, refinery. The Globe plant is rated at 27,000 bbl of crude charge per day. The new unit will be designed to crack 6000 bbl per day of heavy vacuum gas oil charge, with 50 per cent conversion. Feed preparation equipment already available will be employed to supply the charge stock.

Pan American research expansion

An extensive building program to be begun immediately will expand greatly the research and engineering facilities for Pan American Refining Corp. in Texas City, D. J. Smith, president, has announced. Plans include converting present administration building to a research center, with a new 3-story process laboratory to be added. A new administration building, 279-ft by 101-ft will be built, with an auditorium for seating 250 persons, in which staff meetings and educational assemblies will be held.

Ethyl alcohol plant completed by Shell

Completion of a plant for the synthesis of ethanol (ethyl or 'grain' alcohol) has been announced by Shell Chemical Company, the plant being located at Houston, near the Shell refinery. This process depends on the hydration of ethylene gas, C_2H_4, obtained as a byproduct of refining operations.

All alcohol produced in this plant will be consumed in industrial applications, and the alcohol will be produced in carefully supervised operations. It will be sold under the trade name "Neosol" as a proprietary solvent, and in various denatured forms approved by the U. S. Government. The applications of ethyl alcohol, (ethanol) in industrial operations are wellnigh numberless, and includes, drugs, lacquers, dyes, cosmetics, plastics, rayon, anti-freeze, vitamins,

Vitameter injects anti-knock liquid into motor carburetor

The Vitameter, an instrument for injecting anti-knock materials into the fuel systems of automotive engines, is being offered to customers by three oil companies in Toledo, Ohio, and the device will be available soon to prospective users all over the country. Service stations of Pure Oil Company, Shell Oil Company and Standard Oil Company (Ohio), are offering the new development to customers, to be installed on motor car engines.

This device injects small controlled quantities of anti-knock liquid into the carburetor or manifold of automotive engines to improve the effective octane ratings of fuels used therein. A mixture of alcohol and water has been studied in experimental operations, and this may be the product used in the Vitameter for general public application.

Injection of this material has the effect of raising the octane rating of a given fuel by as much as 10 to 20 numbers, A. T. Colwell, vice president of Thompson Products Company of Cleveland, and of Thompson Toledo Vitameter Corporation which makes and supplies the equipment, states. This arrangement will increase the ton-mile economy of an automotive unit (engine) by as much as 25 per cent, Colwell stated, and will enable cars of the future to run satisfactorily on present-quality fuels. The net effect will be to increase importantly the total yield of motor fuels by the oil industry, and increase correspondingly the total of transportation which will be supplied to and for the nation as a whole. It is considered a major crude oil conservation idea by many refining and automotive engineers.

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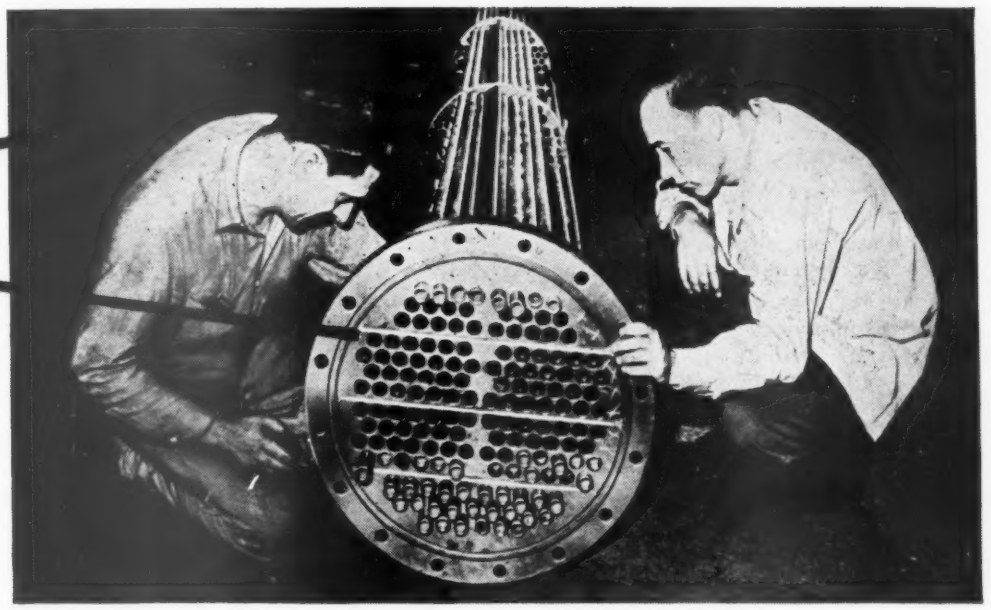

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NEWS

U. S. refining capacity nears 6,000,000 bbl mark

U. S. refining capacity will be 5,919,000 bbl of crude by the end of 1948, according to estimates supplied by Fred Van Covern of the American Petroleum Institute to the Refining Capacity Committee of the National Petroleum Council, recently. These figures are estimated by Van Covern as "probaly about one per cent on the low side.

"It is quite apparent," says Robert E. Wilson, Chairman of the Board of Directors of Standard Oil Company of Indiana and chairman of the committee, "That the expansion of refinery capacity must flatten off from now on." Even relatively inefficient capacity is being operated now at near capacities, but in spite of almost superhuman efforts to expand capacities the excessive cost of construction, of shortages of steel, etc., the problem of refinery capacity is likely to be a bottleneck for the next 12 months, especially if increase of demand continues, Wilson said. The committee will undertake a new refinery capacity survey in September, if the Council desires it, the chairman stated.

Todd field gasoline plant

Continental Oil Company has been appointed the operator of a natural gasoline plant to process the 10,000,000 cu ft of gas produced in the Todd (Deep) Field, West Texas, to make recovery of 60,000 gal of natural gasoline per day. Continental Oil represents the 23 operators in the field, which are cooperating in the plant. Refinery Maintenance Company of Compton, California, is contractor for the plant, which is planned for completion within a year.

The field contains two producing horizons with 58 wells in the Ellenberger, producing from about 6100 ft: 30 producers are in the Crinoidal, from about 5600 ft depth. The plant will require 25 men to operate it when completed.

Organizes Petrol Refining

Petrol Refining Inc., was organized recently by Petrol Terminal Corporation, and three eastern farmer cooperatives, Southern States Cooperative, Pennsylvania Farm Bureau Co-op. Association, and Cooperative Grange League Federation Exchange. The new company operates a refinery at Texas City, Texas, with a curent refining capacity of 17,000 bbl of crude per day. It also owns three T-2 tankers. It is capitalized at $10,000,000 and is headed by E. M. Callis as president and general manager; first vice president V. A. Fogg, Ithaca, New York; other officials are vice presidents F. F. Sweeton of Philadelphia and V. E. Smith of Texas City; secretary, W. G. Williams, Philadelphia; treasurer and comptroller, J. W. Presson, Baltimore, Maryland.

New thermoplastic developed by Kellogg Company

Manufacture in limited commercial quantities of a new plastic, KEL-F, has been announced by M. W. Kellogg Company. This product is a polymer of trifluoro-chloroethylene, is highly inert chemically, colorless, and shows strong resistance to attack by acids and other chemicals. One of its outstanding features is its susceptibility to heat treatment, whereby its properties may be enhanced to meet a given requirement. It is said to be excellent material for pump and valve packings, valve seats, also gage glasses and other uses where corrosion is an important factor. It is useful at temperatures ranging from minus 320 F to 390 F and thus probably has good applications in liquid air, oxygen, nitrogen handling, and production, statements indicate.

To ship old refinery

Socony-Vacuum Oil Company has bought the Pathfinder refinery at Los Angeles, it is understood, for transfer to Naples, Italy, to aid in rebuilding the refinery of Raffineria di Napoli S. A., a Socony subsidiary, destroyed during the war. The Pathfinder plant's original capacity was 2000 bbl of crude per day, and includes a 2-coil thermal cracker catalytic polymerization unit and a gas recovery plant.

Phillips Chemical takes over ordnance ammonia plant

Cactus Ammonia Plant, operated by Emergency Export Corporation since the war for the Ordnance Department of the Army, has been purchased by Phillips Chemical Co., a subsidiary of Phillips Petroleum Company, and the capacity of the plant will be doubled in the near future. Its present capacity is 70,000 tons annually, it is stated.

G. W. McCullough, vice president and general manager of Phillips Chemical, took over control of the plant from Capt. D. M. McCrea, commanding officer at Cactus, near Etter, Texas, and placed its operation in charge of A. B. Leonard, new superintendent. Within a few weeks construction will be begun by Phillips Chemical on a large ammonium nitrate plant nearby, for the manufacture of fertilizer from the product of the enlarged ammonia plant, it is announced.

Increase gas sales for chemicals

Several billion cubic feet of refinery gases, consisting mainly of ethylene and propylene, the total valued at more than $75,000,000, will be supplied by Standard Oil Company (Ind.) to the chemical plant of Carbide & Carbon Chemicals Corporation at Whiting, Indiana, according to a new 15-year contract made by these companies and announced recently. Such gases have been supplied by Standard to Carbide and Carbon since 1935, but under the new contract the consumption will be on a greatly increased scale. The chemical company uses these gases as raw materials in the synthesis of acetone, alcohols, acetic anhydride, and similar chemicals.

While Standard will use some of its surplus gases for chemical production at its Whiting refinery, most of its activities in that direction will be centered at its Wood River, Illinois refinery, officials stated. In addition Stanolind Oil and Gas Company, wholly-owned subsidiary, will be active in the development of petroleum chemicals derived from the synthesis of liquid hydrocarbons at Brownsville, Texas.

Socony has rubber plasticizer

Perfection of the manufacture of "S/V Sovaloid-A, Special," a new type of plasticizer for natural and synthetic rubbers has been announced by Socony-Vacuum Oil Company's chemical products department. This new product of petroleum chemical development is said to produce tight vulcanizates of excellent aging properties from natural, neoprene and GRS type rubber, and is less susceptible to discoloration than any other commonly used plasticizer.

Shell completes two more chemical plant units

Two new plant units for the synthesis of important organic chemicals from petroleum byproducts are announced by Shell Chemical president Jan Oostermeyer, as part of the $43,000,000 expansion program of that company in the petroleum chemical field. One unit produces ethyl chloride by addition of hydrogen chloride—hydrochloric acid—to the olefin, ethylene, the latter being formed in large quantities in several refining processes. Large-scale delivery of this important chemical intermediate will begin in about four weeks, Oostermeyer stated. It is employed widely as an intermediate in the synthesis of plastic, lacquers and many other chemicals, and its application is expected to enlarge as the assured supply becomes greater.

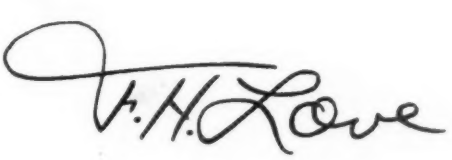
GAS IMPROVEMENT

The large gas pipe line systems without exception are operating at capacity loads, but with demand for natural gas as a fuel for industrial and domestic consumption constantly increasing, construction of new facilities never quite seems to catch up with this demand. The principal reason, of course, is the difficulty in obtaining line pipe. To give aid in this emergency a new approach is being made to the problem by the American Gas Association and the U. S. Bureau of Mines. These two organizations have undertaken a cooperative study to determine means for removal of nitrogen and other non-combustibles from natural gas at its source in the field, which would in effect considerably increase the capacity of existing pipe lines by enabling them to carry natural gas of higher heat value.

As a part of the program, a pilot plant has been installed at the Bureau of Mines' Exell helium plant near Amarillo, Texas, and test runs are now being made. Recently a two-day conference was held in Amarillo in order to permit engineers to obtain greater familiarity with technical and economic phases of the problem and to discuss possible means for its solution. An important part of the program was the presentation by engineering contractors of prospective nitrogen removal processes.

The degree to which the presence of non-combustibles reduces the effective carrying capacity of pipe line systems is discernible from the known facts. Natural gas from certain large reserves, notably those in the Texas Panhandle and Hugoton, Kansas, fields, contain a nitrogen content of between 10 and 15 per cent. Gas from some parts of the area contains as high as 30 per cent nitrogen. The principal interest in the problem, obviously, centers in these reserves due to the fact that they are the source of gas for some of the most important cross-country pipe lines. It has been estimated, for example, that approximately $500,000,000 is invested in pipe line facilities to transport gas from these fields. If an average of 12 per cent nitrogen content is assumed, this means $60,000,000, plus a proportional percentage of operating and distribution costs, are being devoted to handling an inert gas. Further, it is estimated that approximately 4000 tons a day of nitrogen are being transported an average distance of 800 miles.

It is, thus, apparent that the problem is an important one the solution of which would add materially to the available supply of usable gas.



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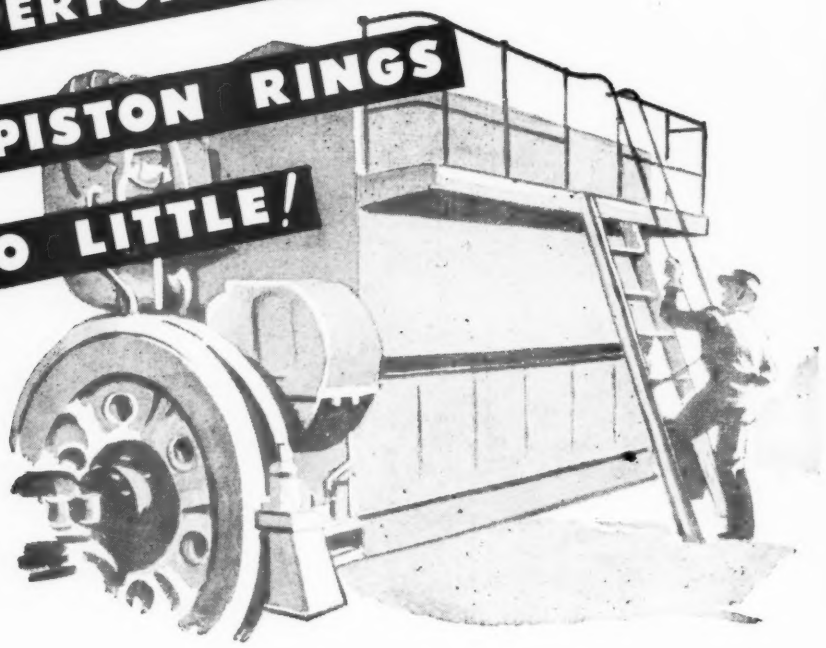

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You Diesel engineers know there is a great difference in piston rings. You have found that two rings may look alike, yet one will prove to be highly successful while the other, a failure. These are facts that most engineers have experienced at one time or another—facts that many engineers have reduced to the simple realization that there are "invisible ingredients" that account for the superiority of the better ring.

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Section of pipe that has been lowered into the ditch. Up ahead can be seen the coating and wrapping operation.

Argentine 1100-Mile Pipe Line

By FRANK H. LOVE*

WITH more than half of the 1100-mile gas line being laid by authority of the Argentine Government between the Comodoro Rivadavia field and Buenos Aires completed, it is expected that this project will be finished some time during the first quarter of 1949. Purpose of the undertaking, which was authorized February 3, 1947, is to make available the country's gas reserves for domestic and industrial consumption. It is proposed first that the gas be made available to domestic consumers in cities along the route of the line and in Buenos Aires. Later, as gas production increases, the fuel will be made available to industries along the Atlantic Coast, and, finally, to industries in the Buenos Aires area.

The northern section of the line, from Buenos Aires to General Conesa, is being laid by the government agency, Direccion General del Gas del Estado, the southern section, from General Conesa to Comodoro Rivadavia, by contract. At last reports, the average daily rate of laying pipe was a total of 2.8 miles for the two sections. The maximum amount of pipe laid in any one week by both sections was 18.95 miles. The government began work on its section of the main line August 6, 1947, and the contractor, Compania Tecnica Internacional, began work February 26, 1948.

In determining the route of the line, which is shown on the accompanying map, it was decided to utilize, insofar as possible, such facilities as were provided by existing national highways, bridges, etc. In this way the acquiring and preparation of considerable right-of-way was eliminated. Also, at many points it has been, and will be, unnecessary to erect new structures to carry the pipe across rivers, roads, natural obstacles, etc. Obviously, such a plan could not be adopted unqualifiedly, as the route would have been too circuitous and added many miles to the total length. For the most part, however, the line is straight and, as mentioned, follows existing highways, which also greatly facilitates the transportation of pipe, materials, and working personnel to the job.

The route chosen passes through the most thickly populated areas in the Atlantic Coast Zone with the exception of the Province of Buenos Aires. In order to follow the shortest route between Bahia Blanca and the City of Buenos Aires, it was necessary to miss the towns of Tres Arroyos, Tandil. Balcare, Mar del Plata, and Necochea. These localities, as well as some others, will be supplied with gas, however, through branch lines laid from the main line as soon as the demand makes it apparent that the laying of such lines is justified.

The line is being laid of two types of pipe, specifications of which are

*Pipe Line and Marine Transportation Editor.

EXCLUSIVE

shown in Table 1. Joints are being electric welded, both by the rolling weld and stove-pipe methods, and the pipe is being coated and wrapped as protection against corrosion. The ditch has a minimum depth of 75 cm (29.5 in.) and a minimum width of 50 cm (19.7 in.). In rocky areas that require the use of air hammers or explosives to make the ditch, the depth is reduced to 50 cm in the interest of economy. Other than in such areas the trench is made by conventional ditching machines.

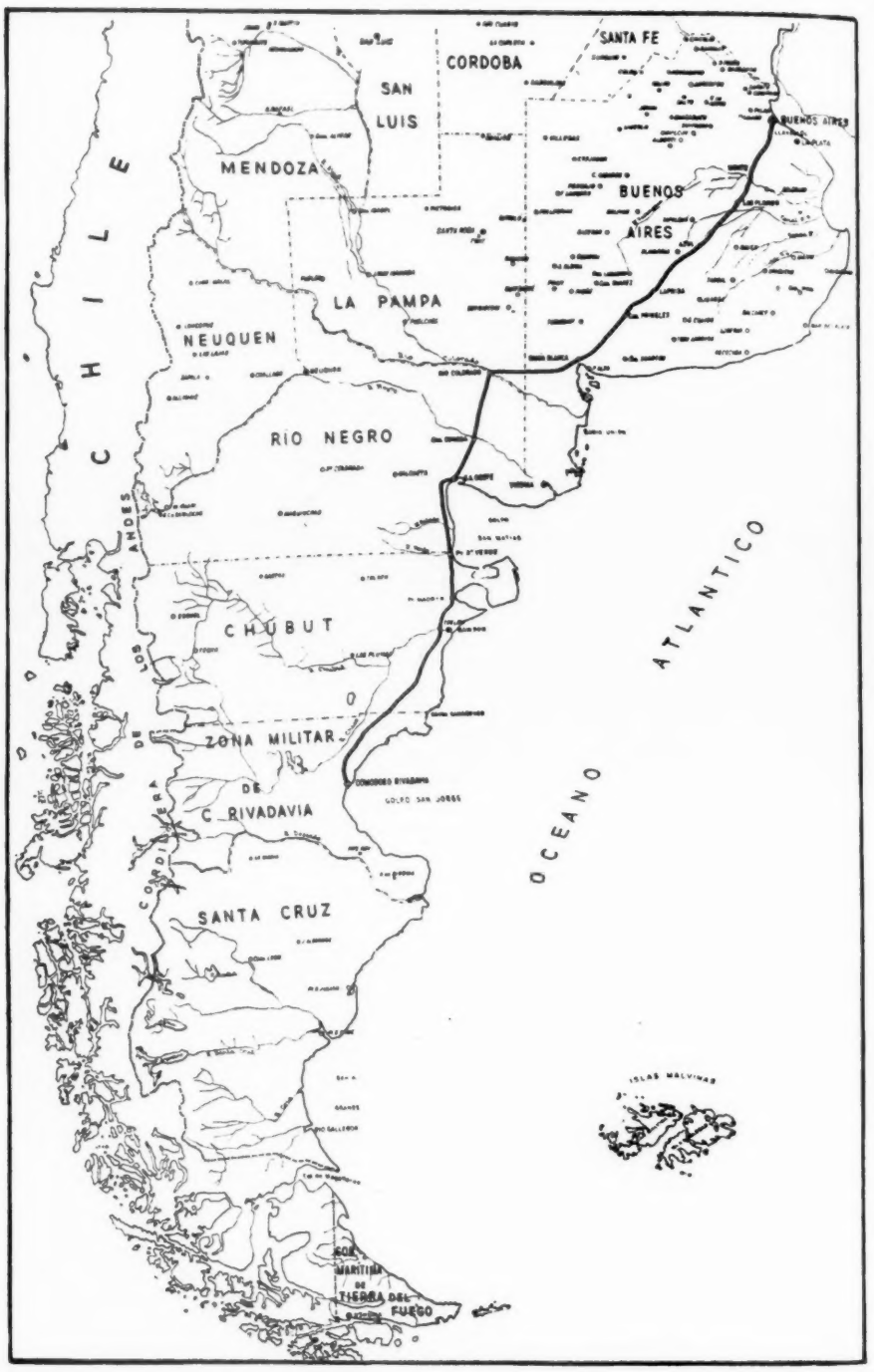
In making welds, an inside line-up clamp, hydraulically operated, is used. A minimum of two beads is run in addition to the stringer bead when the joints are welded by the rolling method. When stove-piping a minimum of three beads is used. The pipe is being received from the manufacturing plants with the ends beveled at a 30-deg angle.

One method employed to inspect welds consists fundamentally in establishing in the metallic part to be inspected an intense magnetic field and to sprinkle the part with magnetic oxide of iron. If an invisible flaw exists, a distortion of the magnetic field is produced in proximity to the defect, free magnetic poles appearing at the surface of the weld. The oxide of iron adheres to the magnetized area revealing the flaw, the magnitude and type of which the inspectors are able to determine on the basis of the appearance of the pattern or figure so formed.

Bends are being made cold, by use of the conventional pipe bending machines, and care is being taken to assure that no angle is of a degree that will hinder the passage of a scraper through the line.

Before the pipe is lowered-in it is first cleaned, then given a primer coat, after which coating and wrapper are applied. The coating is applied to a thickness of approximately 5 mm (0.2 in.). An electronic type holiday detector is then run to locate faults in the coating. The finding of such flaws is announced by the emission of a spark and is immediately marked for patching.

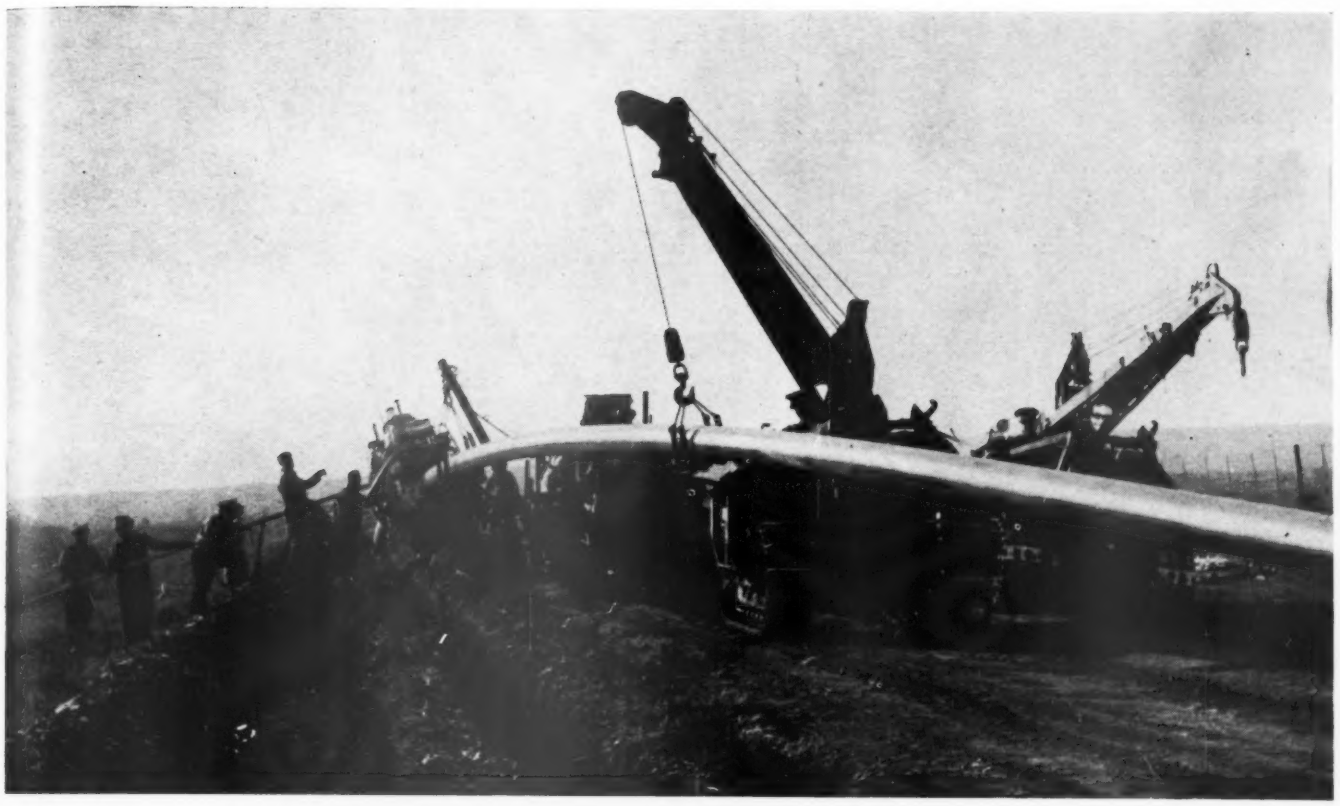
The pipe is "crowded" into the ditch and a slack loop left up on a skid every 500 meters (547 yards) to be lowered-in during a cool period of the day, to provide for contraction and expansion of the line during changes in temperature. Records show, however, that this change in soil temperature will be very slight in the Comodoro Rivadavia area. Temperature of the soil is virtually constant during any one season of the year, varying within a margin of 3 C. For the year as a whole, the maximum temperature



Map showing route of the line from Comodoro Rivadavia field to Buenos Aires. Insofar as possible the line follows existing highways, and bridges and other facilities provided are utilized. This also greatly facilitates the transportation of pipe, other materials, and working personnel to the job.

TABLE 1. Line pipe characteristics.

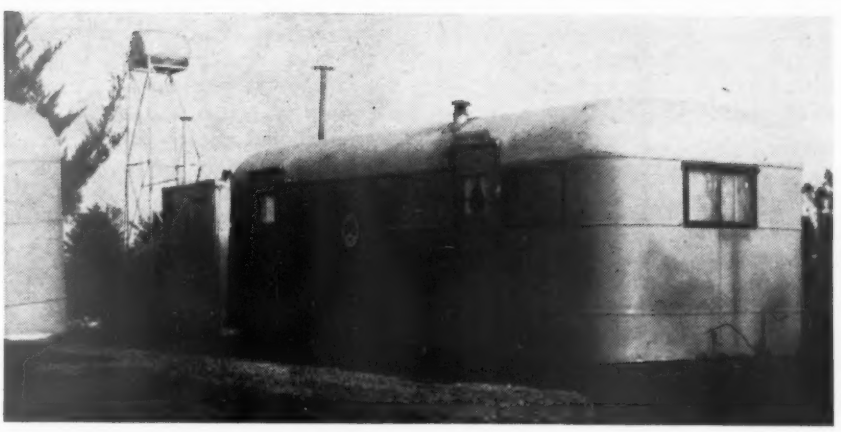
	Type 1	Type 2
Outside diameter	254 mm (10 in.)	273 mm (10¾ in.)
Wall thickness	5.75 mm (0.226 in.)	6.35 mm (0.25 in.)
Weight	32.2 kg/m (23.65 lb/ft)	41.7 kg/m (28.02 lb/ft)
Average length	10 m (32.8 ft)	10 m (32.8 ft)
Tensile strength (min.)	5000 kg/sq cm (71,115 psi)	4200-4900 kg/sq cm (59,737-69,693 psi)
Limit of elasticity (min.)	3000 kg/sq cm (42,669 psi)	2460-2950 kg/sq cm (34,989-41,958 psi)
Hydrostatic test	80 kg/sq cm (1137.8 psi)	80 kg/sq cm (1137.8 psi)
Elongation	18 per cent	18-20 per cent
Chemical composition		
Carbon	Max. 0.30 per cent	0.15-0.25 per cent
Manganese	Max. 0.70 per cent	0.30-0.90 per cent
Sulphur	Max. 0.06 per cent	0.055 per cent
Phosphorous	Max. 0.04 per cent	0.045 per cent
Method of fabrication	Seamless	Longitudinal weld

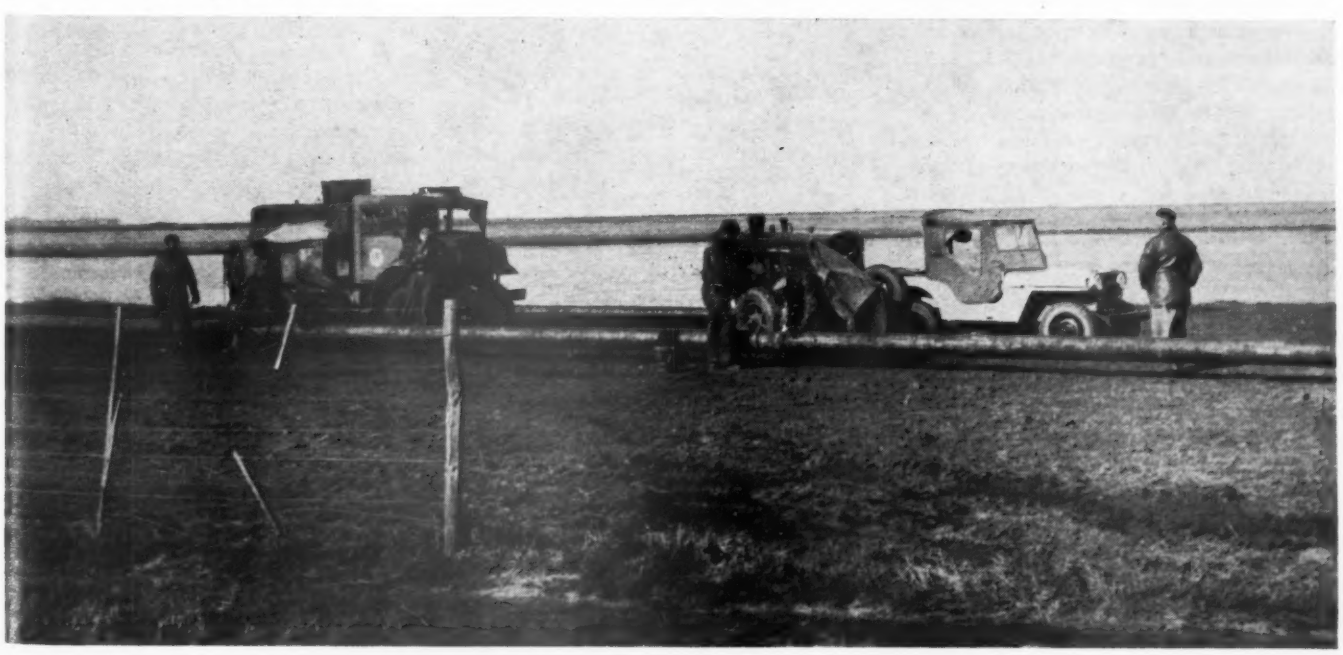


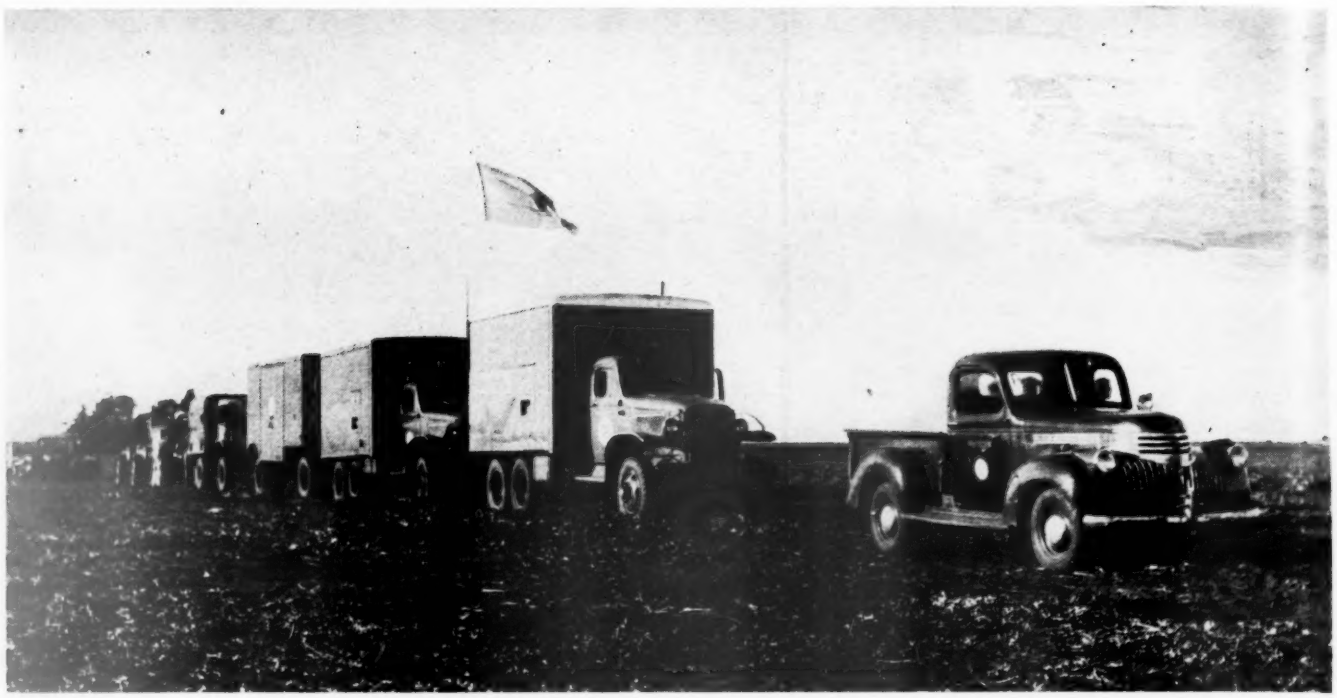
Above, pipe is being cleaned and a primer paint applied.

Right, trailer house used by the director general at base camp.

Below, joints are electric welded, both by rolling-weld and stove-pipe methods. These welders are making roll welds.







In the field the workmen live in camps. This photograph shows a mobile camp being moved to a new location after the scene of activity on the line has moved away from its vicinity.

is 21 C and the minimum 5 C, thus the pipe is submitted to a maximum winter and summer temperature variation of only 16 C.

Block valves are being installed approximately every 30 km (18.6 miles) in the Comodoro Rivadavia-Bahia Blanca-Buenos Aires area. This permits the isolation of sections without interruption to service, as may be necessary from time to time for purposes of making repairs, tying-in branch lines, running scrapers, etc.

Once completed, the sections between block valves are submitted to two tests to determine the tightness of the welded joints. The first test is by applying an air pressure of 18 kg per sq cm (256 psi) to the 30-km (18.6 miles) section of pipe and leaving for a period of 24 hr. The second test is at a pressure of 75 kg per sq cm (1067 psi) and also for a period of 24 hr. After the line is completed, it is planned to again test the line at a pressure of 75 kg per sq cm before placing it in service. In some instances a soap suds test at an air pressure of about 8 kg per sq cm (114 psi) is made prior to the two tests mentioned. Usually this is done only at the beginning of each section to check the efficiency of the welds, or in the case of joints the tightness of which it is absolutely necessary to be certain before the section is welded into the line.

As mentioned, existing facilities are being utilized whenever possible. For example, in certain instances bridges can be used to carry the line across rivers or smaller streams. When this is done, hardwood planking is used to support the pipe. In most cases valves are installed on each side of the bridge.

When making a crossing under a railroad track, the pipe is cased, and the ends of the line pipe and the casing sealed by a coupling. Vents are then installed to release to atmosphere any gas that might escape due to a leak in the pipe.

At river crossings where no usable bridges are available, the pipe is being laid in trenches below the bed of the river. In the case of narrow rivers the joints of pipe are welded together on shore and the whole pulled into place by tractors equipped with winch lines. Before being pulled into place, however, the pipe is given a double coating and double wrapper and slatted to give protection to the coating during the operation.

Two parallel lines, and in some cases more, are being installed at all important navigable river crossings in order to assure uninterrupted service in event of damage at such a point.

☆ ☆ ☆

Ultimate capacity of the Trans-Arabian pipe line can be increased to 500,000 bbl a day by a change in design, B. E. Hull, president, announces. This capacity can be attained by adding six booster pump stations to reinforce the initial six pump station project.

Gate valves are placed on each line and on both sides of the river. These crossings are being laid from barges, one joint being welded on at a time and the barge moved out from under, allowing the pipe to submerge. Wall thickness of the pipe used for river crossings is 50 per cent greater than that used on the rest of the line, and the welds are required to be reinforced. The pipe is weighted with river clamps weighing a minimum of 500 kg (1102 lb), and specifications call for a covering of at least 2 meters (6.56 ft) in the case of navigable rivers and 1 meter (3.28 ft) on other stream crossings.

In some few instances the velocity of the streams are too swift or the depth too great to make the procedure just described feasible. In such instances suspension bridges will be constructed.

Eng. Julio V. Canessa, general director of Dirrecion General del Gas del Estado, Argentina, is director of the project. Eng. Carlos Lucero Flores is assistant general director of the exploitation department; Eng. Pedro F. Rodriguez, assistant technical director of the project; Eng. Esteban R. Pérez, superintendent of the section comprising Buenos Aires-General Conesa; Alberto Carizzo, assistant superintendent of the same section, and Eng. Casildo L. Pacella, chief inspector of the section comprising Comodoro Rivadavia-General Conesa, which is being constructed by the contractor.

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EXCLUSIVE

Middle East Pipe Lines

By FRANK H. LOVE*

ALTHOUGH the Middle East has approximately 40 per cent of the world's proved oil reserves, production totals only about 1,000,000 bbl a day due to lack of pipe line facilities. If the supply of line pipe becomes available, this output is expected to be at least doubled within the next few years as a result of the completion of pipe lines now being constructed or planned. To move oil from Saudi Arabia, Iraq, Iran, and Kuwait to the eastern shores of the Mediterranean, oil companies are planning to invest hundreds of millions of dollars in these facilities.

The Middle East pipe line most prominent in the day's news is that of the Trans-Arabian Pipe Line Company, being constructed of 30 and 31-in. pipe and laid from Saudi Arabian oil fields to the Levant Coast. The line, 1070 miles in length, will have its origin at Abqaiq, Saudi Arabia, and will terminate at Sidon, Lebanon. Initially the line will transport 300,000 bbl of crude oil a day, of which 75,000 bbl will go to the refinery to be built by Mediterranean Refining Company at Sidon, the remainder being available for offshore shipment.

The movement of 300,000 bbl a day is taking into consideration the utilization of six pumping stations spaced at intervals of approximately 180 miles. By the installation of six intermediate booster stations and additional tankage and terminal structures, the capacity of the line later can be increased to 500,000 bbl a day.

Another project under way is the construction by Iraq Petroleum Company of two 16-in. lines from the Kirkuk field, Iraq. One line, from Kirkuk to Haifa, was begun in 1946 and is completed insofar as laying of the pipe is concerned except for 40 miles on the western end. Disturbed conditions in Palestine have caused a suspension of operations. The new line parallels the company's existing 12-in. line, and, although the laying of pipe has ceased, work is in progress on the enlargement of pumping stations. This line will have a capacity of 90,000 bbl a day, and it is hoped to have it finished in 1949. Upon completion of the Kirkuk-Haifa line, it is proposed to lay a 16-in. line from Kirkuk to Tripoli, which also will parallel an existing 12-in. line and is planned for operation sometime in 1951. The total length of these two projects is 1080 miles.

Iraq Petroleum Company also proposes to lay a line from Kirkuk to Tripoli, a distance of approximately 556 miles. This system will be of 30-32 in. pipe and will have a capacity of 300,000 bbl a day.

A 34-36 in. line from Iran to the Mediterranean is proposed by the Midle East Pipe Line Company, owned jointly by the Anglo-Iranian Oil Company, the Standard Oil Company (New Jersey), and Socony-Vacuum Oil Company, Incorporated. Kuwait production also is to be tied into this line. The overall length of the project would be approximately 800 miles; capacity about 535,000 bbl a day.

Consideration is being given also to another line from Kuwait to the Mediterranean, this one to be built by the Gulf Oil Company and the Shell group. It would be laid of 30-32 in. pipe and the capacity would be 300,000 bbl a day.

▸ **Existing Pipe Lines. Iraq.** There are two 12-in. pipe lines from the Kirkuk field to the Mediterranean Coast, one terminating at Haifa, Palestine, the other at Tripoli. The Kirkuk-Haifa line is 621 miles in length and the Kirkuk-Tripoli line 532 miles. Construction of the line to Tripoli was completed in July, 1934, and the first oil reached that point on July 14. The line to Haifa was completed in October, 1934, and the first oil was delivered on October 14. This was exactly seven years after oil was first found in the Kirkuk field.

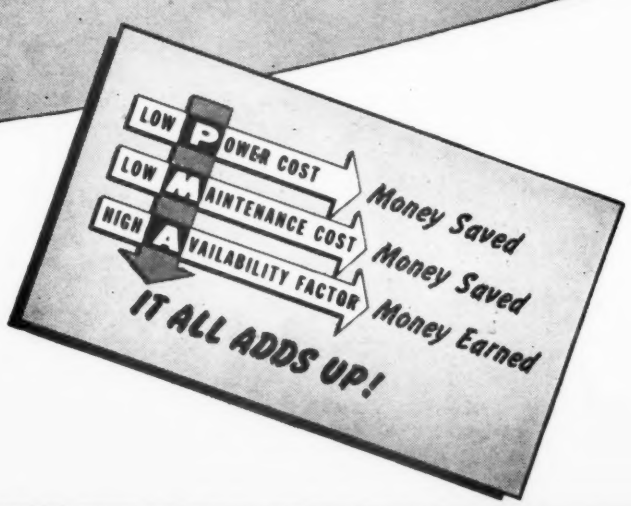
Both lines have a capacity of 2,000,000 tons of crude oil per year.

Inasmuch as the two lines occupy a common right-of-way from Kirkuk to the Euphrates where they bifurcate, one line going north to Tripoli and the other south to Haifa, the first three pump stations (K-1, K-2, and K-3) are double stations. Each is capable of pumping 85,000 bbl of oil a day. Beyond station K-3, the T stations on the

Map showing Middle East pipe lines that are in operation, those under construction, and those proposed.

*Pipe Line and Marine Transportation Editor.

For the Big and Little Inch pipelines



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THE centrifugal pipeline boosters now pumping gas through the Big and Little Inch pipelines of Texas Eastern Transmission Corporation represent the most revolutionary development in the history of high pressure gas transmission. This is the *first* time that centrifugal boosters have been used commercially for this service—*and the boosters selected were Ingersoll-Rand.*

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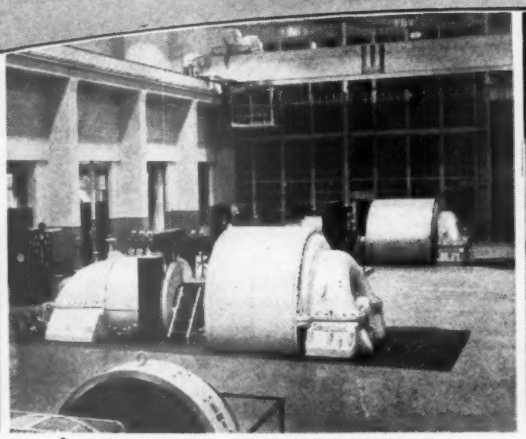
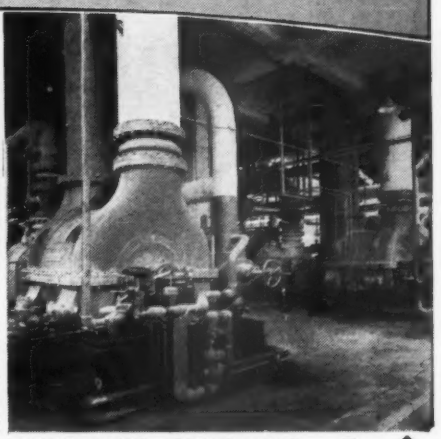
other applications of I-R Blowers:

↑ GAS BOOSTING in a steel plant. Three 27,000-cfm, 6-psi blowers... motor driven, 1000-hp each at 3600 rpm.



↑ BLAST FURNACE BLOWING with Ingersoll-Rand Turbo-Blowers ...11,500-hp each, turbine driven... 100,000-cmf, 30-psi pressure each.



CATALYTIC CRACKING... Two Ingersoll-Rand Turbo-Blowers... 1700 hp each, 15-psi pressure... turbine driven. ↑

← CONVERTER BLOWING with six Ingersoll-Rand Turbo-Blowers... 2000-hp each, motor driven... 25,000-cfm each.

→ SEWAGE DISPOSAL... Six 2000-hp direct connected Ingersoll-Rand Turbo-Blowers... 42,500-cfm, 7.5-psi pressure each.

northern line and the H stations on the southern line are each capable of pumping 42,500 bbl a day.

The stations are equipped with 6¾-in. by 24-in. horizontal duplex double-acting pumps directly connected to 500-hp diesel engines. K stations have six such units and T and H stations three each. Engine fuel consist of crude oil taken from the pipe line. Operating pressure of the line is 800 psi.

At the Haifa terminal there are thirty-six 93,000-bbl storage tanks: at Tripoli terminal there are 27 tanks of the same capacity. Twenty-nine of the tanks normally are used for crude oil received from Kirkuk via transshipment from the Tripoli terminal or by tanker from Kuwait. The other seven tanks are for fuel oil storage. Crude oil received at Haifa from Kirkuk by pipe line goes direct to the refinery of Consolidated Refineries, Ltd. Products from the refinery are pumped to the oil dock through nine 12-in. lines and into storage consisting of nine 93,000-bbl tanks, four 32,000-bbl tanks, and three 10,000-bbl tanks.

In addition to operations of the Iraq Petroleum Company, the Khanaqin Oil Company, which is owned by the Anglo-Iranian Oil Company, has oil production in the Naft Khaneh field of eastern Iraq, and from this field there is a pipe line to the company-owned refinery at Khanaqin.

▸ **Saudi Arabia.** In 1939 a 10-in. line was completed from Dhahran to the Ras Tanura refinery, a distance of 33 miles. This line has a capacity of 63,000 bbl a day. In 1945 a 12-in. line was laid from Dhahran to the Island of Bahrein, its crude oil destined for the refinery of the Bahrein Petroleum Company, Ltd. The capacity of the line is 117,000 bbl a day, and of its total of 34 miles, 17 miles are under the waters of the Persian Gulf, making it the world's longest commercial submarine pipe line. During 1947 the land portions of the line were looped with 12-in. pipe. The year 1946 saw two lines constructed, one 23 miles in length from Dhahran to the Ras Tanura Terminal, the other 40 miles in length from Abqaiq to Dhahran. The former is of 12-in. pipe and has a capacity of 123,000 bbl a day. The Abqaiq-Dhahran line is a combination 12 and 14-in. line and has a capacity of 100,000 bbl a day. In 1947 another line was laid from Abqaiq to Dhahran, this one of 14-in. pipe and having a capacity of 105,000 bbl a day. The last line to be completed was in 1948, from Abqaiq to the Ras Tanura refinery, a distance of 61 miles. This is a combination, 20, 22, and 30-in. line and has a capacity of 326,000 bbl a day.

▸ **Iran.** The last pipe laid in Iran was in 1948, the first in 1911. From the Masjid-i-Sulaiman field to Abadan, where the Anglo-Iranian Oil Company, Ltd., operates one of the largest refineries in the world, there are two 10-in. lines and one 12-in., the distance being 133 miles. From the Haft-Kel field to Abadan, a distance of 136 miles, there are two parallel 12-in. lines. Another line from this field extends to Kut Abdulla where it joins the main line to Abadan. Abadan also receives crude from the Agha Jari field through 12-in. lines that vary in number from two to four in the course of the route (97 miles), the system being incomplete. A 12-in. line, 166 miles in length, delivers crude oil from the Gach Saran field to Abadan; a 12-in. line, 124 miles in length, connects the Haft-Kel field with Marid, and a combination 10 and 12-in. line, 32 miles in length, extends from Naft Safid (White Oil Springs) to Wais. In addition, there is a 12-in. line from the Agha Jari field to Bendur Mashur, a distance of 45 miles, and a 3-in. line from Naft-i-Shah fiield to Kermanshah, a distance of 146 miles. ★ ★ ★

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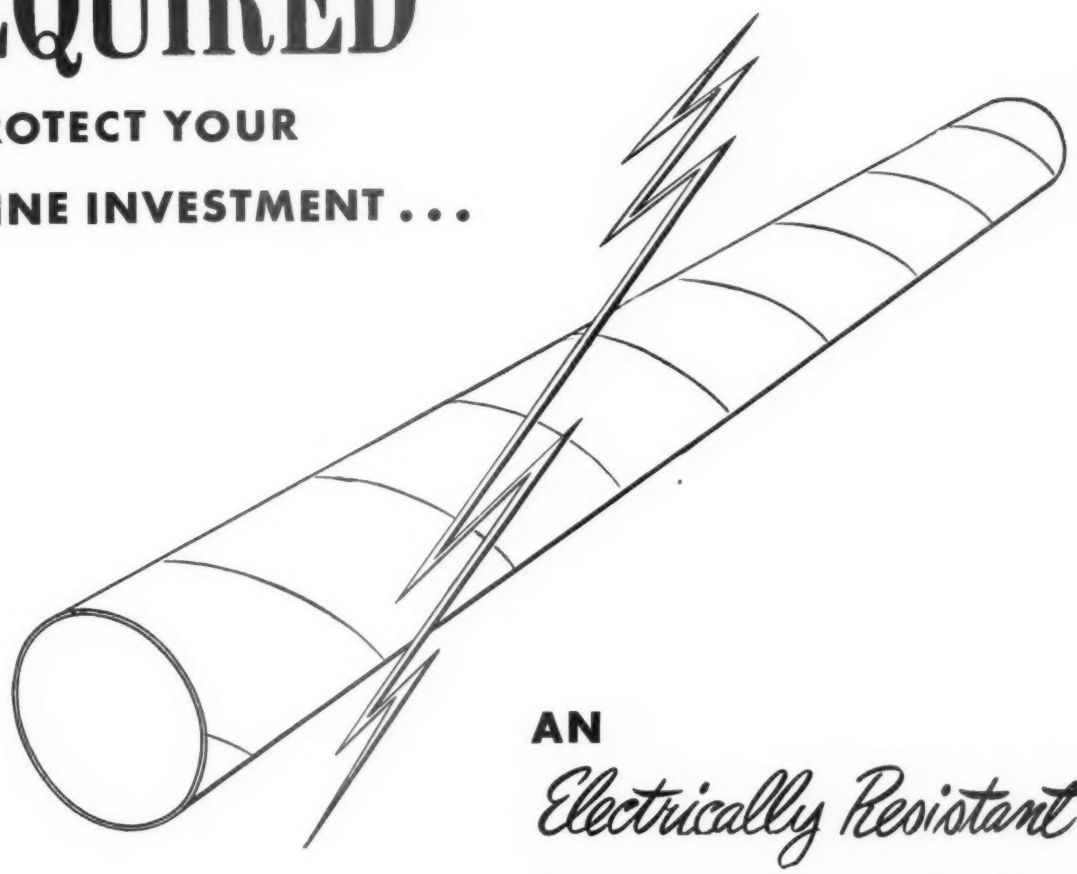

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Interfacial Mixing Characteristics of Products in Products Pipe Line*

By S. S. SMITH and R. K. SCHULZE, Shell Oil Company, Inc.

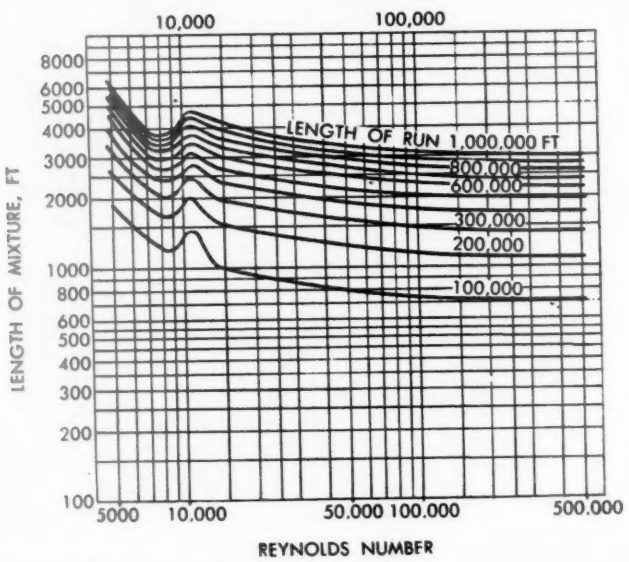
PART 2

The first problem, which was approached objectively, was to find some stable reference point to which we could relate our data. All evidence at hand indicated that if we were to relate pilot size lines to commercial lines we should use a length/diameter ratio or some Reynolds Number relationship. Brown and Fowler used length/diameter ratios and average Reynolds Numbers as indices. We tried every combination of these we could conceive, and none of them gave smooth relationships between data derived in pilot plant and the large amount of information we had on commercial lines 4 in. to 12 in. in diam. We also tried to fit our mixing data into a percentagewise function of the length of line traveled. Still no neat relationships were found. We experimented with Reynolds Numbers of the lighter product, of the heavier product, the arithmetical average of the two Reynolds Numbers, the kinematic viscosity of the single or the average of the two products and still found no satisfactory agreement in pilot plant and field results. Finally, in our experimental use of various yardsticks, we found good agreement in the pilot plant results when we used the Reynolds Number of the 50/50 mix actually determined from laboratory checks of viscosity against length (not length/diameter ratio) of mixture. When the data were used in the field we found some considerable spottiness, but by this time we were well convinced of the accuracy of our pilot plant data and the inaccuracy of our field data. Therefore, we made some special field checks in which we provided the necessary automatic sample determinations by continuous gravitometer to provide commensurate accuracy to that we had in the pilot plant. As the data derived from these special checks gave excellent agreement with pilot plant, we at this point pursued the subject far enough to demonstrate that the accuracy of results from spot sampling in the field leaves much to be desired from the standpoint of accuracy. We found that samples taken at one-minute intervals did not give the data that our continuous recording units gave, but since the latter gave regularly reproducible data while the former did not, we finally trusted only the gravitometer methods.

As we accumulated data we constructed cross plots of the information, and the mathematicians in our group applied such theoretical checks as they could. As a final result, we obtained several basic data sheets that seemed easily usable and accurate within engineering design limits. The first of these is Fig. 12, which relates Reynolds Numbers and feet of pipe traveled to feet of mixture in the pipe line. This chart has a familiar look because the form of the curves indicates the same peculiar characteristic at low Reynolds Numbers as does the friction curve for flow in pipe lines when transition is effected from laminar to turbulent flow. The Reynolds Numbers used in this set of curves were the Reynolds Numbers of the 50/50 mixtures of products handled and apply regardless of whether there is a wide spread between viscosities such as exists between No. 3 fuel oil and gasoline or whether there is a narrow spread as between kerosine and prime white. The length of contamination in feet is easily

*Presented before Division of Transportation Subcommittee on Products Pipe Line Technology during the 27th Annual Meeting of the American Petroleum Institute, Chicago, Illinois, November 10, 1947. Also presented before the 1947 Conference on Petroleum Mechanical Engineering, Houston, October 6-8, 1947, sponsored by Petroleum Committee, American Society of Mechanical Engineers.

FIG. 12. Graph of mixture distances of 100,000 ft of run vs Reynolds number of 50/50 product blends.



EQUATION OF CURVES FOR REYNOLDS NUMBER GREATER THAN 20,000.

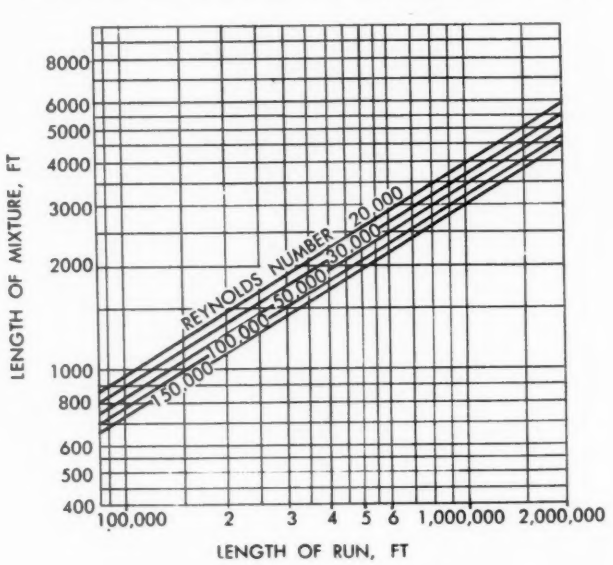
WHERE $M_L = (1.075\,R^{-0.11} + 0.5501)\,L^{0.43}$

M_L = LENGTH OF MIXTURE IN FEET.

R = REYNOLDS NUMBER OF 50/50 BLEND = $\frac{DVS}{U} = 7{,}741.856\,\frac{DV}{R}$ { D = INTERNAL DIAMETER OF PIPE IN IN. V = VELOCITY FT/SEC R = KINEMATIC VISCOSITY CENTISTOKES

L = LENGTH OF RUN IN FEET

FIG. 13. Graph of mixture versus length of run, related to Reynolds numbers of 50/50 product blends



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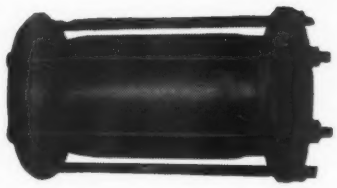

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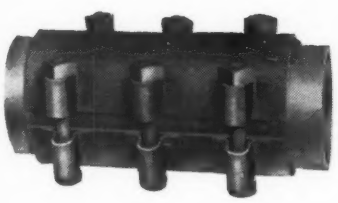

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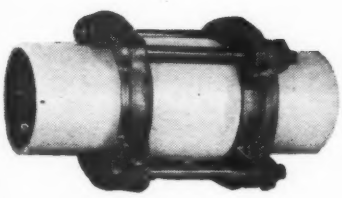

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converted to barrels or gallons as desired, but plotted as we have done it is directly applicable to any diameter of pipe. For reasonable accuracy it is best to make actual viscosity determinations in the laboratory on the 50/50 mixture.

One point should be noted. From friction of flow data we approximately confirm in the 2-in. experimental line the same coefficient of friction curves that were published by Heltzel. It is to be noted that the critical breaks in mixing came at quite different Reynolds Number than the critical region in the friction curve. We think the explanation of this difference is the fact that average velocities required to get turbulence to the pipe wall are higher than those required to get a reduction in friction factors. This statement is equivalent to saying that the friction factor is agreeably affected when the core of the stream is in turbulent flow while there still exists an appreciably thick film of material at the wall that remains in laminar flow. But to support small interface mixtures requires velocities sufficiently high to carry turbulence up to the pipe wall, with the absolute minimum of wall film in laminar flow.

One of the encouraging things about the use of these data is that they apply even though the Reynolds Number of the heavier product indicates it to be at one that would give heavy intermixing. To us at least this was quite a surprise as we had assumed that both products' needs must be well in the turbulent flow range. These facts have been amply verified in field operations since our laboratory work was done.

The same data have been put together in another chart shown in Fig. 13. This chart shows a family of curves each at different Reynolds Numbers for the 50/50 mixture and plots distance traveled in the pipe line in feet against the feet of length of the total mixture, and because all differences are in logarithmic sequence it is quite easy to use this chart at interpolated values. It should be pointed out in summing up this work that all of our figures are from data that used 99 per cent purity of single product as the end point of the mixture. At this degree of purity the analysis of gravitometer charts is subject to some degree of error when the gravity differences between products are small, and in the use of these data in the field good agreement will only obtain if the accuracy of field sample is equal to that of the laboratory work. This is well illustrated in comparison of calculated to observed mixtures by field tests. Fig. 14 shows calculated versus observed mixtures on a 6-in. line at two points of takeoff. These data show large differences between calculated gasoline-gasoline mixtures, and observed mixtures obtained by field samples, in all cases the field data showing less mixing than indicated from our experimental data. This simply proves the impossibility of observing 1 per cent and 99 per cent purity points on an ordinary hydrometer when the gravities of the two products are nearly the same. In our own work we have practically discontinued field observation by hand-drawn samples as a result of the sort of information we have just shown you. Fig. 14 is notably interesting as showing the lower limits of velocity at which ordinary commercial lines may be operated —the lowest figures being obtained from a run at 50 bph consuming over 300 hr transit time. We have no doubt that these figures are lower than usually contemplated by operators of products lines.

Figs. 15, 16, and 17 show data on 8-in., 10-in., and 12 in. lines, and again the agreement is excellent where field data can be considered reliable. In this connection note the agreement between calculated barrels of mixture and gravitometer observed receipts of gasoline-kerosine at the end of 220 miles of run on our 8-in. line at commercial rates.

Please note that where there are large differences between calculated and observed field results, the error, if any, is

FIG. 14. 6-in. line.

L, length of run, ft	Avg. temp., F	k (from chart)	v ft/sec	$R=\frac{V}{k}=46{,}955$	$(1.075\,R^{-0.87}+0.550)$	$L^{0.62}$	Mixture		
							Calculated		Observed
							C_L ft	Bbl	Bbl
Gasoline-gasoline									
299,060	53	0.747	0.38	23,900	0.7172	2490	1787	63.9	41.2 (45.6)*
	58	0.730	0.76	48,900	0.6393	2490	1593	57.0	(37.5)*
	63	0.710	1.12	74,000	0.6121	2490	1525	54.5	32.9 (34.1)*
	64	0.707	1.52	101,000	0.5974	2490	1489	53.2	(27.9)*
	Est. 60	0.720	3.77	246,000	0.5719	2490	1425	51.0	29
	Est. 60	0.720	3.76	245,400	0.5722	2490	1428	51.0	33
517,440	60	0.720	3.76	245,400	0.5722	3495	2000	71.6	37
Gasoline-kerosine									
299,060	Est. 60	1.231	3.75	143,000	0.5854	2490	1459	52.2	49
	Est. 60	1.231	3.75	143,000	0.5854	2490	1459	52.2	53
517,440	Est. 60	1.231	3.77	143,900	0.5852	3495	2045	73.2	66

*Mixture by color charge.

FIG. 15. 8-in. line.

L, length of run, ft	Avg. temp., F	k (from chart)	v ft/sec	$R=\frac{V}{k}=61{,}788$	$(1.075\,R^{-0.87}+0.550)$	$L^{0.62}$	Mixture		
							Calculated		Observed
							C_L ft	Bbl	Bbl
Gasoline-gasoline									
291,298	Est. 60	0.720	4.64	398,500	0.5645	2465	1391	86.1	52
606,514	Est. 60	0.720	4.25	364,500	0.5655	3840	2172	134.3	71
895,488	Est. 60	0.720	4.15	356,000	0.5659	4920	2784	172.4	85
1,168,147	Est. 60	0.720	4.66	400,000	0.5644	5820	3285	203.5	104
1,457,808	Est. 60	0.720	4.80	412,000	0.5639	6640	3744	231.6	107
1,852,118	Est. 60	0.720	4.69	402,500	0.5643	7730	4362	270.0	105
Gasoline-kerosine									
291,298	Est. 60	1.231	4.36	218,800	0.5743	2465	1416	87.6	87
606,514	Est. 60	1.231	4.36	218,800	0.5743	3840	2205	136.7	128
895,488	Est. 60	1.231	4.36	218,800	0.5743	4920	2825	175.0	156
1,168,147	Est. 60	1.231	4.36	218,800	0.5743	5820	3342	207.0	200
1,168,147	Est. 60	1.231	4.47	224,400	0.5737	5820	3339	206.7	199*
Kerosine-fuel oil									
291,298	Est. 60	3.270	4.59	86,700	0.6046	2465	1490	92.1	57
606,514	Est. 60	3.270	4.59	86,700	0.6046	3840	2322	143.8	150
895,488	Est. 60	3.270	4.59	86,700	0.6046	4920	2975	184.1	190
1,168,147	Est. 60	3.270	4.59	86,700	0.6046	5820	3519	217.8	214

*Mixture by gravitometer.

FIG. 16. 10-in. line.

L, length of run, ft	Avg. temp, F	k (from chart)	v ft/sec	$R=\frac{V}{k}=77{,}420$	$(1.075\,R^{-0.87}+0.550)$	$L^{0.62}$	Mixture		
							Calculated		Observed
							C_L ft	Bbl	Bbl
Gasoline-kerosine									
286,915	61.8	1.217	7.63	485,500	0.5622	2420	1362	132	200
591,730	62.0	1.214	7.63	486,000	0.5622	3800	2138	208	245
859,003	60.9	1.224	7.63	482,000	0.5623	4790	2693	262	289
1,134,250	59.6	1.235	7.75	485,500	0.5622	5690	3200	311	337
1,393,867	60.6	1.226	7.75	489,000	0.5621	6455	3633	353	360
1,650,898	55.7	1.272	4.60	280,000	0.5695	7200	4100	398	387
1,883,746	52.6	1.302	5.03	299,000	0.5686	7185	4445	432	424

FIG. 17. 12-in. line.

L, length of run, ft	Avg. temp., F	k (from chart)	v ft/sec	$R = 92{,}900\frac{V}{k}$	$(1.075\ R^{-0.87}+0.550)$	$L^{0.62}$	Mixture		
							Calculated		Observed
							C_L ft	Bbl	Bbl
Gasoline-kerosine									
322,186	68.5	1.160	7.37	590,000	0.5603	2600	1458	204	248
661,109	65.5	1.185	7.36	576,500	0.5605	4090	2292	321	340
1,018,301	66.4	1.178	7.41	584,000	0.5601	5320	2982	417	404
1,402,896	65.1	1.189	7.57	591,000	0.5603	6490	3638	509	476
1,726,085	60.9	1.223	7.62	579,000	0.5604	7250	4060	568	544
2,033,803	61.0	1.222	7.62	579,000	0.5604	8135	4555	637	608
2,279,534	60.0	1.231	5.97	450,000	0.5630	8710	4905	686	653

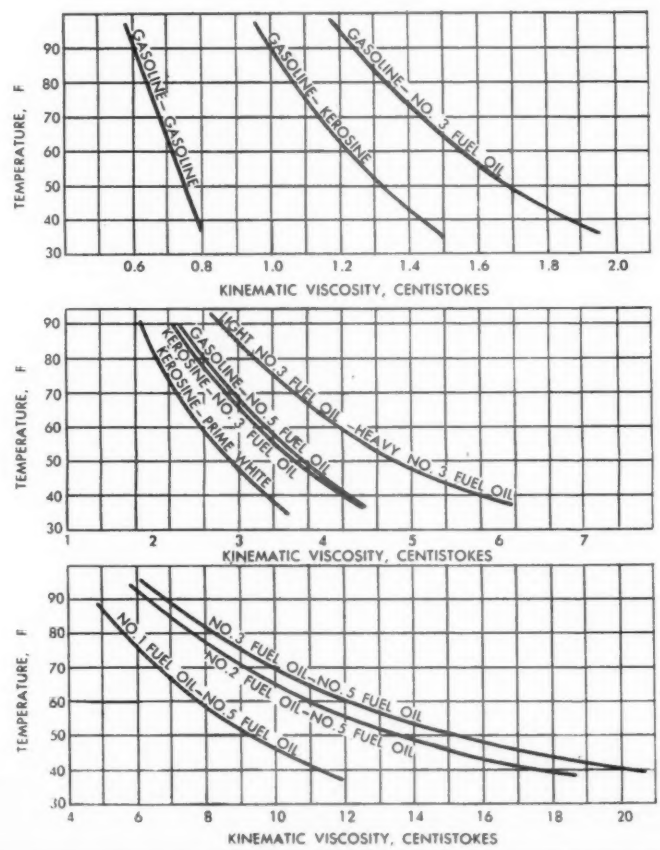
on the side of conservatism and that the observations shown here, unless otherwise noted. are one-minute samples checked by ordinary field hydrometer. None of these differences invalidate the method. They only point up how far usual sampling methods and field operations fall short of absolute accuracy.

To assist in the easy solution of mixture problems we have made up a chart of viscosities of 50/50 mixtures of the now common materials handled in products lines shown on Fig. 18. These were made to cover our own materials, but the major specifications of similar liquids in other companies in all likelihood will show only minor differences, and these charts should be usable on most problems where it is inconvenient to make laboratory determinations of kinematic viscosities of the actual mixtures.

Our Reynolds Number calculations were in English units. This is another nuisance calculation, so again we made a simple nomograph of Reynolds Numbers for straight edge calculations, and it is hoped that this will be helpful in the solution of these problems. This is shown in Fig. 19.

Earlier in the paper mention was made of the characteristic sine wave form of the composition curve of product mixtures when plotted as a function of specific gravity and throughput. This constitutes the most useful tool we have in handling cuts between products and may be used in two simple ways. The first is shown diagrammatically in Fig. 20, which illustrates a typical sine curve with a portion of it representing a mixture curve as it arrives at a pipe line

FIG. 18. Typical kinematic viscosities of 50/50 product blends.


TEMPERATURE, F
KINEMATIC VISCOSITY, CENTISTOKES
GASOLINE–GASOLINE
GASOLINE–KEROSINE
GASOLINE–NO. 3 FUEL OIL
LIGHT NO. 3 FUEL OIL–HEAVY NO. 3 FUEL OIL
KEROSINE–NO. 3 FUEL OIL
KEROSINE–PRIME WHITE
NO. 3 FUEL OIL–NO. 5 FUEL OIL
NO. 2 FUEL OIL–NO. 5 FUEL OIL
NO. 1 FUEL OIL–NO. 5 FUEL OIL

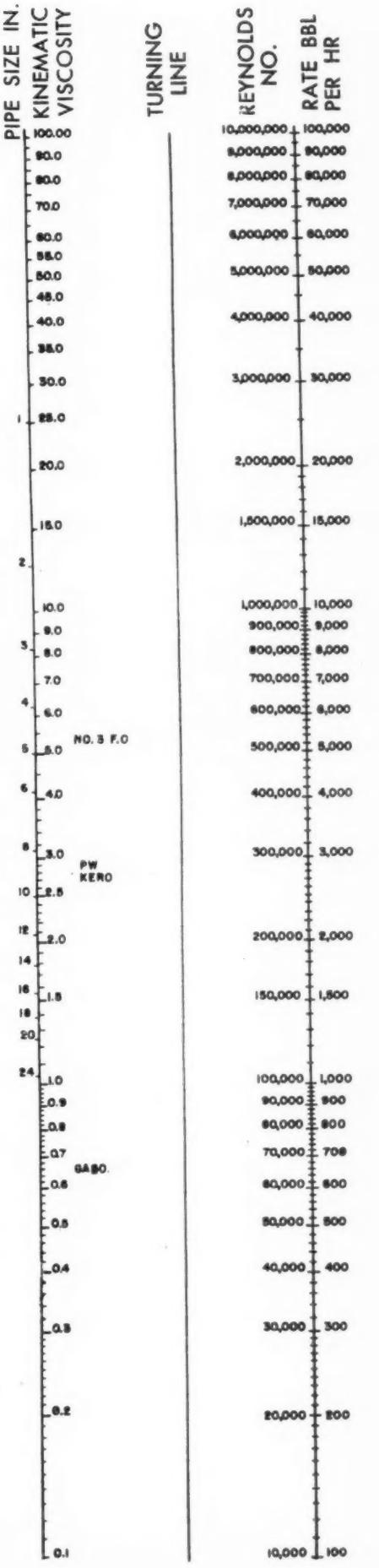


FIG. 19. Nomograph Reynolds Numbers.

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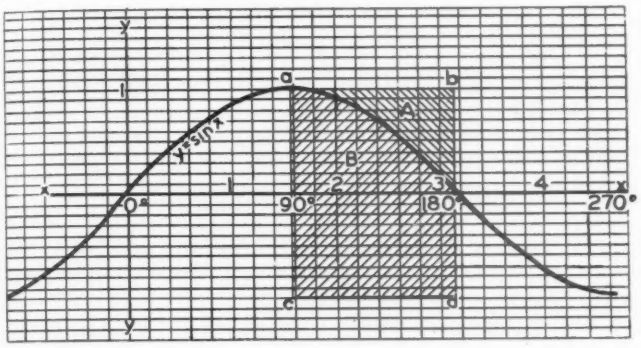
NR-48-1

"Keeps new tanks new...Makes old ones do"

terminal. In actual practice this curve can be predicted within close limits of accuracy if the batch head is observed by gravitometer or hand sampling as it transits the line and before it arrives at our project terminal. In dispatching office routine this plot can be made up before arrival within limits of accuracy probably better than our usual spot sampling methods. My co-author of this paper, Russ Schulze, who, unlike me, is a mathematician, assures me that Fig. 20 is usably accurate. From this it will be seen that a mid-gravity cut point at our project terminal will take only 18 per cent of the total mixture as non-specification product into the alternate product tank. If a cut point at 25 per cent of the mixture is taken in order to better protect the specification of one more vulnerable product, the amount of non-specification product taken into the specification product will be reduced to 5 per cent of the total mixture, with a resultant increase of specification product into the other and less vulnerable one of 35 per cent. This is the easier way to use the sine curve of product change.

A slightly more complex method that avoids any difficult mathematics and may be tailored to fit the problem is shown in Fig. 21, where, by simple plotting of a kerosine - gasoline product change curve into units of 10 or 20 bbl, it is possible to arrive at the exact number of barrels of non-specification product to be cut either way. Both methods allow necessary precalculations to be made in the

FIG. 20. Analysis of a typical sine curve showing the theoretical percentage of product mixture with cuts at the 50 per cent and 25 per cen points of total mixture.



Gravity change from pure product to 50 per cent mixture represented by area "A" equals 18.17 per cent of total area A + B as determined by integration of sine curve.

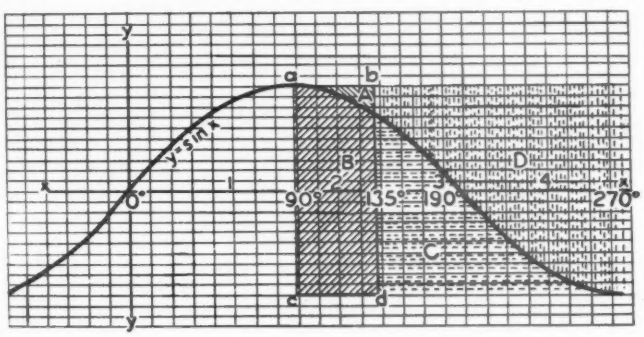
AREA UNDER CURVE ABOVE X AXIS BETWEEN 90° AND 180° $= \int_{90°}^{180°} \text{SIN} \times dx = -\text{COS} \times \Big]_{90°}^{180°}$

$= 1$

THEREFORE AREA $A = 1 \times \frac{\pi}{2} - 1 = 0.5708$

AND RATIO OF AREA A TO TOTAL AREA

$$A + B = \frac{A}{A+B} = \frac{0.5708}{2\left(1 \times \frac{\pi}{2}\right)} = 0.1817$$



Gravity change from pure product to 25 per cent mixture represented by area "A" equals 4.98 per cent of total area A + B as determined by integration of sine curve. Remaining 55 per cent mixture represented by area "C" equals 34.99 per cent of total area C + D.

AREA UNDER CURVE ABOVE X AXIS BETWEEN 90° AND 135° $= \int_{90°}^{135°} \text{SIN} \times dx = -\text{COS X} \Big]_{90°}^{135°}$

$= 0.7071$

THEREFORE, AREA $A = 1 \times \frac{\pi}{4} - 0.7071 = 0.0783$

AND RATIO OF AREA A TO TOTAL AREA

$$A + B = \frac{A}{A+B} = \frac{0.0783}{2\left(1 \times \frac{\pi}{4}\right)} = 0.0498$$

AREA $C = \int_{135°}^{180°} \text{SIN} \times dx + 1 \times \frac{3\pi}{4} - \int_{180°}^{270°} \text{SIN} \times dx$

$= -\text{COS} \times \Big]_{135°}^{180°} + 2.356 - (-\text{COS} \times)\Big]_{180°}^{270°}$

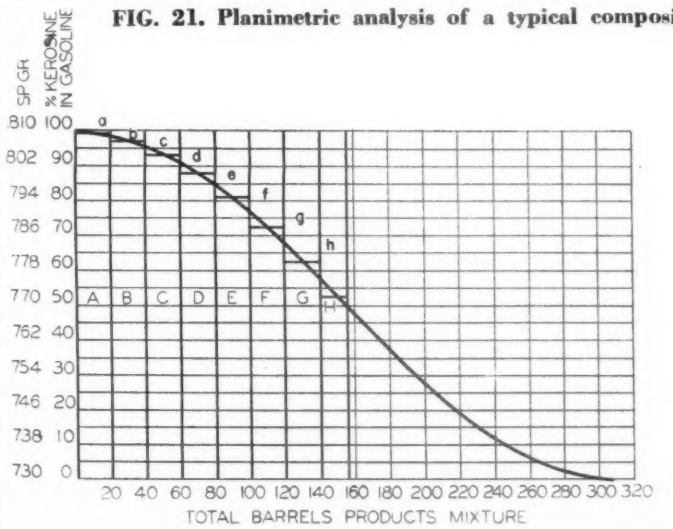
$= 0.2929 + 2.3562 - 1$

$= 1.6491$

THEREFORE, RATIO OF AREA C TO TOTAL AREA

$$C + D = \frac{C}{C+D} = \frac{1.6491}{2 \times \frac{3\pi}{4}} = 0.3499$$

FIG. 21. Planimetric analysis of a typical composition curve to determine point of product cut.

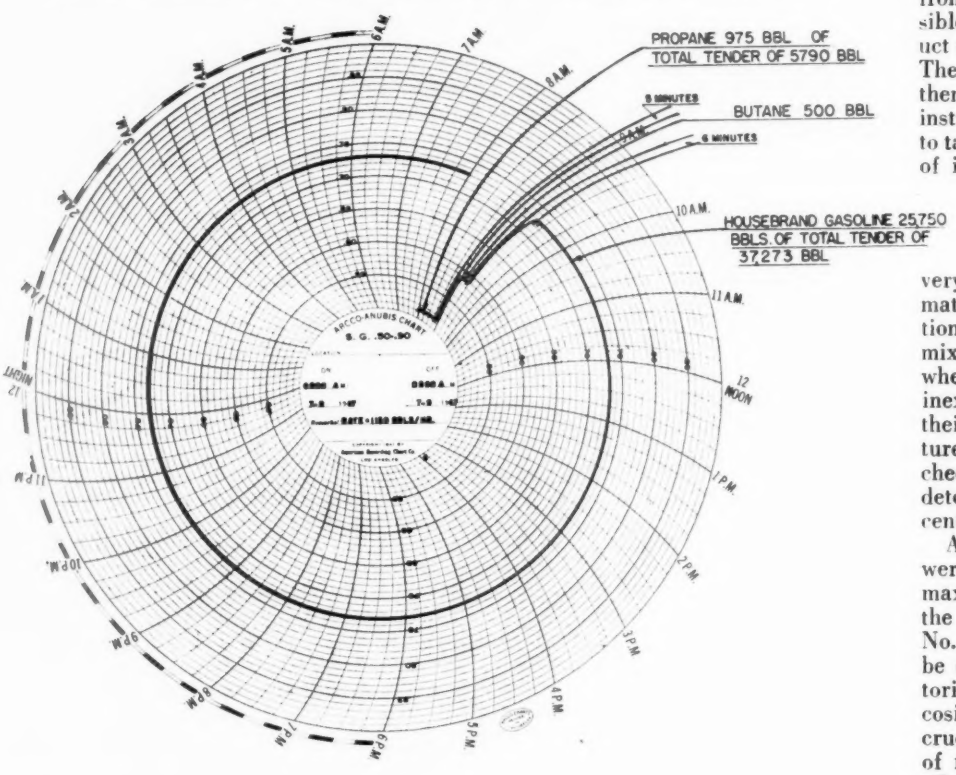


COMPOSITION OF MIXTURE					
	BARRELS GASOLINE			BARRELS KEROSINE	
Area	Volume	Cumulative Total of Area	Area	Volume	Total
a	.2	.2	A	19.8	19.8
b	.6	.8	B	19.4	37.2
c	1.4	2.2	C	18.6	57.8
d	2.4	4.6	D	17.6	75.4
e	3.8	8.4	E	16.2	91.6
f	5.5	13.9	F	14.5	106.1
g	7.5	21.4	G	12.5	118.6
h	7.6	29.0	H	8.4	127.0

EXAMPLE—FROM THE ABOVE TABLE.

IF A CUT IS MADE AT 50% GRAVITY CHANGE (SP. GR. 0.770) A MIXTURE CONTAINING 29.0 BARRELS OF GASOLINE AND 127.0 BARRELS OF KEROSENE WOULD BE OBTAINED.

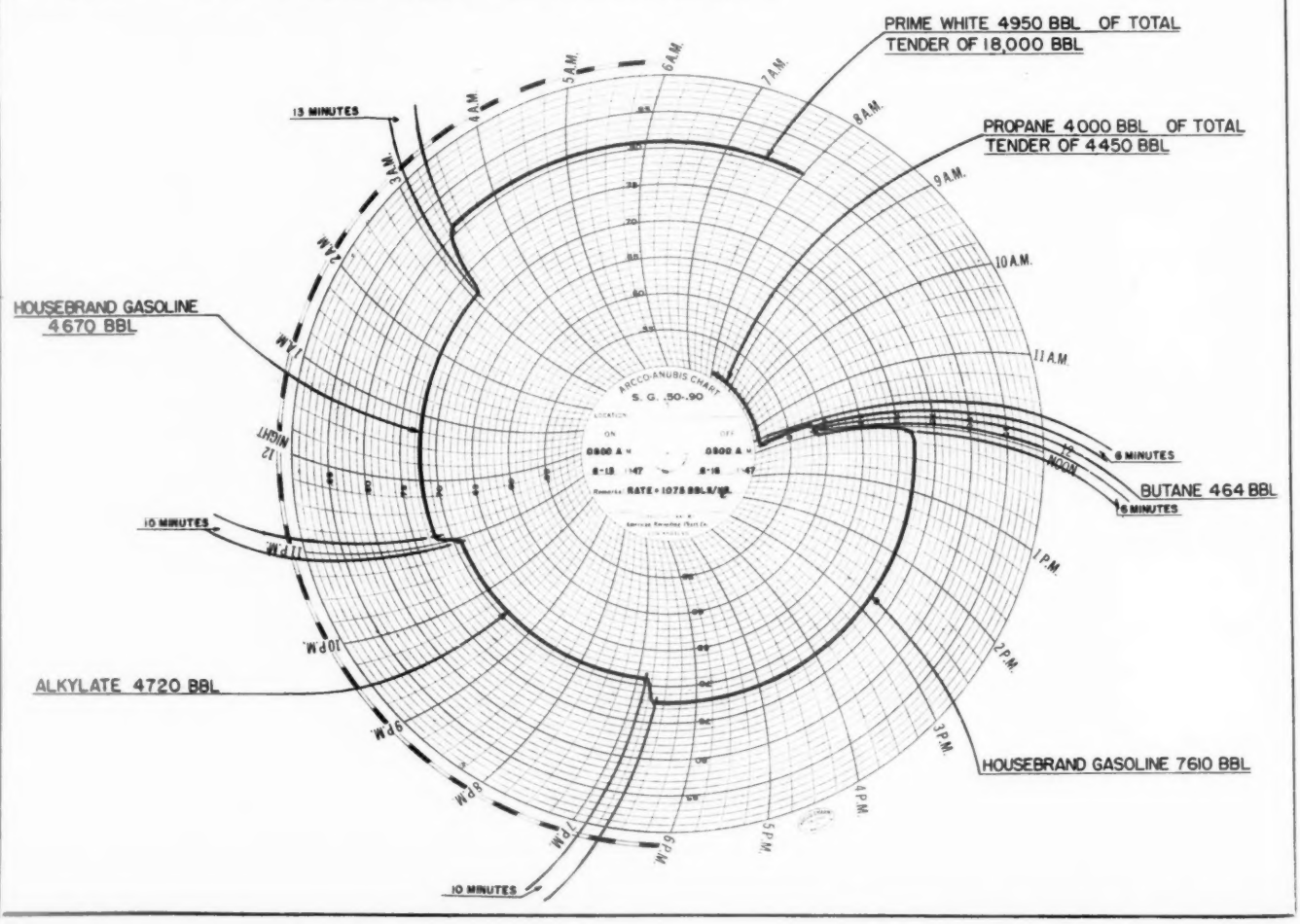
FIG. 22. Recording gravitometer chart showing tender changes at the east Chicago terminal. 8-in. north products pipe line, Shell Oil Company, Inc.


PROPANE 975 BBL OF TOTAL TENDER OF 5790 BBL
BUTANE 500 BBL
6 MINUTES
HOUSEBRAND GASOLINE 25750 BBLS. OF TOTAL TENDER OF 37,273 BBL
ARCCO-ANUBIS CHART
S. G. .50-.90
12 NOON
MIDNIGHT

dispatching office, where are also available all the precollected information from laboratory studies of the permissible degree of admixing that any product can support from any other product. The instructions to field operators can then be simple and concise, simply an instruction to cut from tank number "x" to tank number "y" when specific gravity of incoming stream becomes "z." It is very important to note that this is ultimately much less harmful to specifications than to cut out all or part of the mixture to slop or reblend tanks, because when the latter is done the products are inextricably mixed so that they lose their identity as specific percentage mixtures and must then be laboratory checked against experimental blends to determine new permissible limits of percentage blends.

All the data we have shown so far were established on products having maximum viscosities of 4.1 kinematic, the viscosity of our commercial grade No. 3 fuel oil. Because we wanted to be certain that our facts were satisfactorily interpretable into the range of viscosities represented in the operation of crude systems, we recently made a series of runs between No. 3 and No. 5 fuel oil, the latter having viscosities of 30-44 kinematic. To obtain satisfactory veloci-

FIG. 23. Recording gravitometer chart showing tender changes at the east Chicago terminal. 8-in. north products pipe line, Shell Oil Company, Inc.



ties and Reynolds Numbers on our 2-in. line system on these heavy products it was necessary to set an additional centrifugal pump in series with the original pump equipment. With these changes in the pumping equipment there was the natural question of whether we could reproduce original results on the lighter products. When tested, we found substantial agreement, and thus reassured we made a number of runs on No. 3—No. 5 fuel oils. The data so obtained agreed very closely with similar Reynolds Number observations on the lighter products and verified our original findings as usable on viscous products line operation, provided only that satisfactory Reynolds Numbers be maintained.

One other caution is proper in using these data on field operations. As nearly as possible the experimental line and pump stations are completely streamlined into a single tube with the absolute possible minimum of side connections and dead pockets. This is not always strictly true in the field, particularly of older lines built before some of these more critical types of operation were contemplated. By the same token, the interfaces started in these experiments were sharply cut, and there were no flying switches made across a finite time interval that could give an appreciable admixing before the products actually entered the line. Both of these factors must be given weight in using these data for design or in checking our findings against commercial line operations.

Now a few things about operation practice. In handling propane, butane, butylenes, or other volatiles it is necessary to provide continuous pressures through the system, which will guarantee the product remaining in liquid phase. In our Wood River-Chicago line, where we handle propane and butane on a weekly cycle basis, minimum summer time pressures of 200 psi are maintained at the suctions of the pumps. These pressures are reduced to 150 psi in winter. The line temperatures on this operation range from 30 F minimum in winter to 70 F summer. Pumps are conventional reciprocators with outside packed plungers, the stuffingboxes of which are lubricated under pressure provided by Hills McCanna lubricators. Such minor leakage as occurs at the stuffingboxes is simply wasted. Mixtures between propane and butane are very short due to extremely low viscosities, and the cuts between these products, since butane is not permissible in propane for commercial sale and propane is undesirable in butane for blending into gasoline, are segregated and used or sold as commercial gas fuel. Mixtures between butane and gasoline are cut into gasoline, the percentages involved being so small as not to affect the finished gasoline vapor pressure appreciably. Tender cuts in all cases are made on the basis of gravitometer readings. Fig. 22 shows a typical receipt of propane followed by butane through gasoline with the cut points shown on the gravity curve. Tanks into which propane is received are 250 psi pressure vessels built in pairs, each pair holding about 1200 bbl. They are equipped with pressure vents and automatic float type gauges, and the eight pairs of tanks are filled successively from the line at over 1000 bph rates. Originally these high filling rates gave rise to pressure rises, which caused high rate venting of vapor and heavy vapor losses, but this condition was corrected by installing overhead fill lines that drop the liquid propane the full height of the tank, thus condensing the compressed vapor above the liquid during tank filling.

While on the subject of handling the receipt cuts at receiving terminals, another chart picked more or less at random is interesting. Fig. 23 shows a gravitometer chart covering 24 hr operation on the end of 250 miles of an 8-in. pipe line with six pump stations and the receipt of about 4000 bbl of propane of a 4450 bbl batch, a 464 bbl buffer of butane, a 7610 bbl batch of Super Shell gasoline, 4720 bbl of pure alkylate; 4670 bbl of Super Shell and the first 4000 plus bbl of an 18,000 bbl batch of prime white distillate. The chart shows several significant things. First, the propane-butane and butane-gasoline cuts are extremely short, only in the order of 75-100 bbl, which we would expect. The propane-butane cut was made between pure propane at one end and pure butane at the other and was actually 105 bbl taken to butane-propane mixture tanks as previously noted. The butane-gasoline cut shows on the chart as about 5-6 min at 1075 bph, or 18 bbl a min, and the actual cut in this instance was made during butane receipt so that perhaps 100 bbl was included in the gasoline to raise the vapor pressure of the following 7600 bbl perhaps ½ psi. As this gasoline went into large storage already containing gasoline, there was no appreciable change of specifications. The gasoline-alkylate shows about 10 min or 180 bbl, which was cut to Super Shell gasoline to protect the rigid specifications on alkylate. The next cut of alkylate-gasoline was handled in the same manner. The gasoline-prime white cut, 13 min long, accounts for 184 bbl, cut 75 per cent or 138 bbl to gasoline, which accounts for 48 bbl of prime white cut into gasoline and 25 per cent or 46 bbl cut into prime white which accounts for 2.3 bbl of gasoline cut into prime white. As 18,000 bbl of prime white were following, these 2.3 bbl comprise 0.0127 per cent of the prime white, and the effect of this percentage of gasoline cannot be detected on the flash point of the prime white. Nor is the 48 bbl of prime white in the gasoline enough to affect the residue specification of this gasoline.

It should again be noted, even though the time compression makes these curves look sharper than a sine curve, that they are actually the same curve we got on the high speed chart of the experimental line. Also evident is the impossibility of satisfactory hand sampling in the short space of time involved in these changes.

Pump stations along the lines are equipped with sump tanks to receive the leakage from stuffingboxes, liquid dropped out of strainers, meters and scraper traps during normal operations, etc., and these sumps are equipped with pumps or eductors to reinject product into the line. During the passage of batch heads these sumps are pumped continuously to prevent pumpback of sump into a dissimilar product.

New stations now under construction will have all main line pumps equipped with lubricated mechanical seals, and the sumps will not be expected to handle any continuous dropout of product. Therefore, they will be equipped with eductors, automatically controlled from floats, which will only operate when liquid appears in the sump. In our newer stations every effort has been made to eliminate dead pockets, bypass lines, etc., which can add to mixing effects. How important this is can be illustrated. When we readapted our old crude line from Wood River to East Chicago to handle products, our first batches of fuel oil had tails of 1700-1800 bbl of mixture. After cleaning up side pockets, poorly streamlined manifolds, etc., this figure was reduced to about 300 bbl—not far from a theoretically correct figure.

In summing up, it is felt that these data prove several significant facts as follows:

The use of continuous stream gravitometers calibrated in specific gravity, which can only be used as a direct index of percentage mixing, is desirable and almost necessary in precision dispatching and operation.

As a corollary of that statement, accurate spot time and quantity measurements are imperative to good handling of products in small batches.

The use of data presented here makes possible designs of field installations in which the size of individual batches may be kept at minimum with commensurate savings in pipe line tankage requirements and maximum flexibility of number and kind of products handled.

It is hoped that some of the items presented offer new tools with which can be built improved transportation facilities to meet a critical national need at this time.

Acknowledgment is made to the following people, who assisted in the work leading to the preparation of this paper:

W. J. Curry for field test data to confirm laboratory findings and early laboratory work in connection with the experimental setup.

R. E. Zimmerman for most of the actual laboratory operation.

Norris Plank for the design of the basic experimental pipe line and the gravitometer.

★ ★ ★

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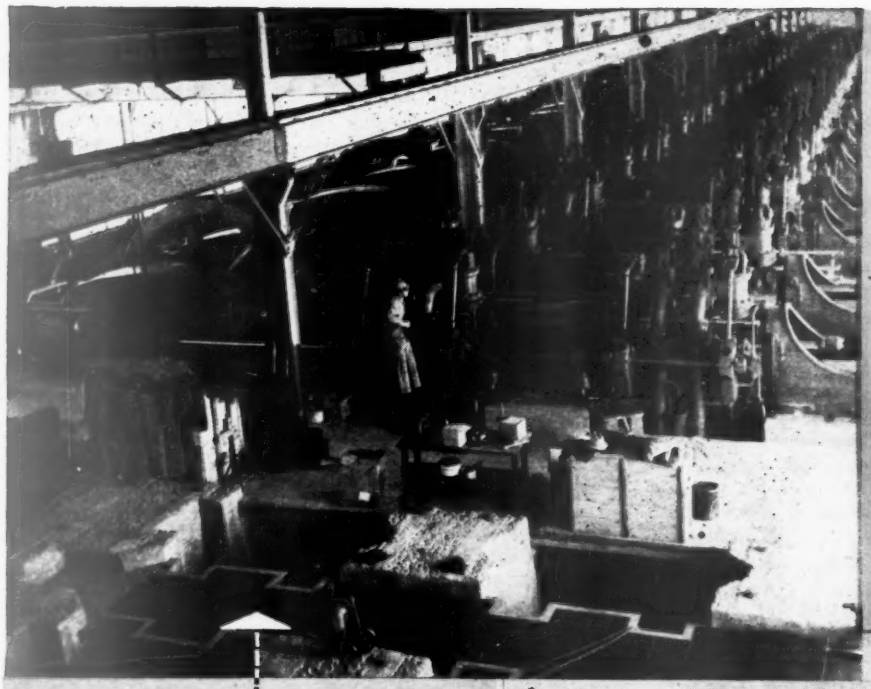
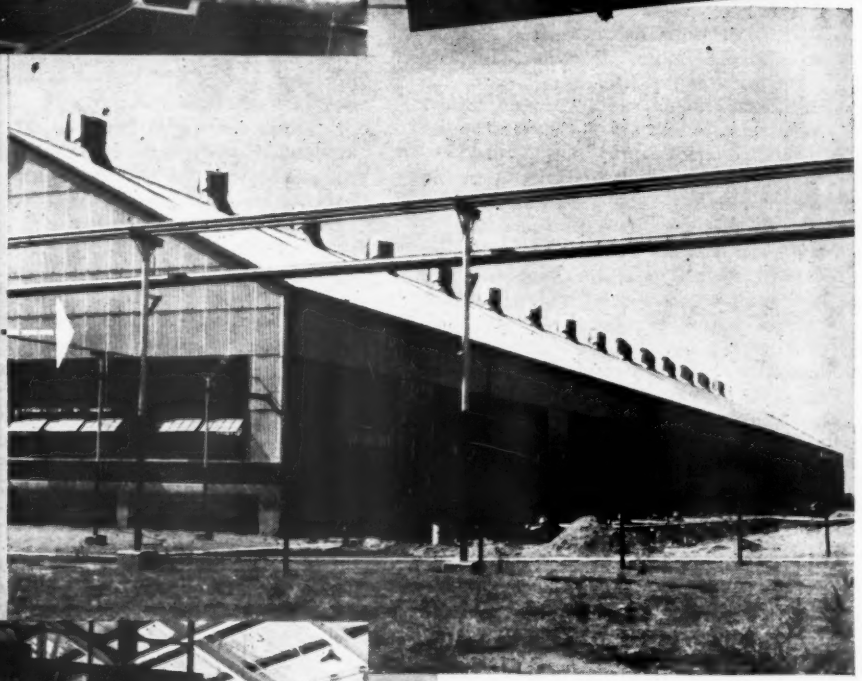
Trans-Continental Gas Pipe Line Company, Inc., has filed a petition with the Federal Power Commission seeking amendment of the FPC order authorizing the company to construct a natural gas transmission system from Texas to New York City. The amendment calls for 30-in. pipe for 1210 miles instead of 26-in. pipe. Total cost, using the 30-in. pipe, estimated at $189,810,154.



Leading

WORTHINGTON HORIZONTAL GAS ENGINE COMPRESSORS WILL TOTAL 135,200 ICHP

Photos taken at one of the country's largest compressor stations — the Stinnett, Texas, plant of the Texoma Natural Gas Company, a company affiliated with the Natural Gas Pipeline Co. of America. Interior views show Worthington Horizontal Gas Engine Compressors (24" x 36", Twin Tandem, 1400 HP each) in process of installation. Starting with 57 of these in 1931, the company will have 104 Worthington units of various types by 1949—for a total of 135,200 ICHP!



Worthington "Angles"

Throughout the oil and gas industries Worthington LTC Angle Gas Engine Compressors are famous for cost-saving, uninterrupted gas-transmission. In refrigeration, and in chemical and other processes as well, this ability of LTC's to carry full loads "around the clock" is proving to a wide range of users that *there's more worth in Worthington* . . . Five sizes of cylinder combinations, 400 to 1000 HP. Write for Bulletin L-690-B1.

pipeline company adds **ANOTHER** *Worthington mass-installation!*

The Natural Gas Pipeline Company of America, since its formation in 1931, has made Worthington units key factors in an outstanding expansion program. By 1949, this will include a line-capacity of 484 million cu. ft. per day—almost triple the original volume!

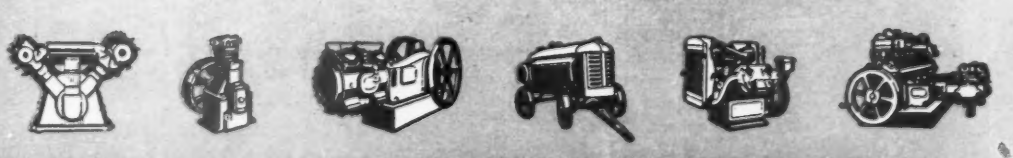
Case histories like this—and Worthington can show you plenty of them—point to facts vital to every user of power or compressor service. Such reorders for multiple installations can only come from complete confidence—based on years of "living with" Worthington equipment, checking continuously on its dependability and economy, comparing it with competitive units.

That's why it will pay you—whether you need one engine or a battery of them—to look further into the many advantages of Worthington Horizontal Gas Engine Compressors. Write for information. *Worthington Pump and Machinery Corporation, Engine Division, Buffalo, New York.*

WORTHINGTON

EK-8-1

NO OTHER COMPRESSOR WILL OUTPERFORM A WORTHINGTON



EXCLUSIVE

Ingenious Gas Line Leak Detector Proves Effective

By RICHARD SNEDDON, *Pacific Coast Editor*

A SHORT time ago the writer described at some length the evolution of line flying from the old practice of line walking. It was an interesting development. Now comes a further departure in leak detection, this time in the form of a clever mechanical smeller that picks up gas line leaks in a most ingenious manner and with an unusual degree of certainty. This effective device was designed and built by two pipe line division foremen employed by Southern California Gas Company on the western end of the "Biggest Inch." They are Harry Gavin, general foreman at Indio, the originator of the idea, and Maxwell Orr, foreman at Blythe, who helped to iron out the wrinkles, and finally convert the Gavin idea into a working reality.

The apparatus, which looks like a plow mounted on semi-circular slides, is drawn by a four-wheel drive Power Wagon. To and from the job, the sniffer slides easily over the ground on skids made from sections of 30-in. pipe like that used in building the line. In operation, the plow blade is submerged into the trench backfill to a depth of about 14 in. The blade itself is made from a ¼-in. steel plate edged with haystellite. Welded to the back edge is a ½-in. pipe terminating in several ⅛-in. holes at the point of the blade.

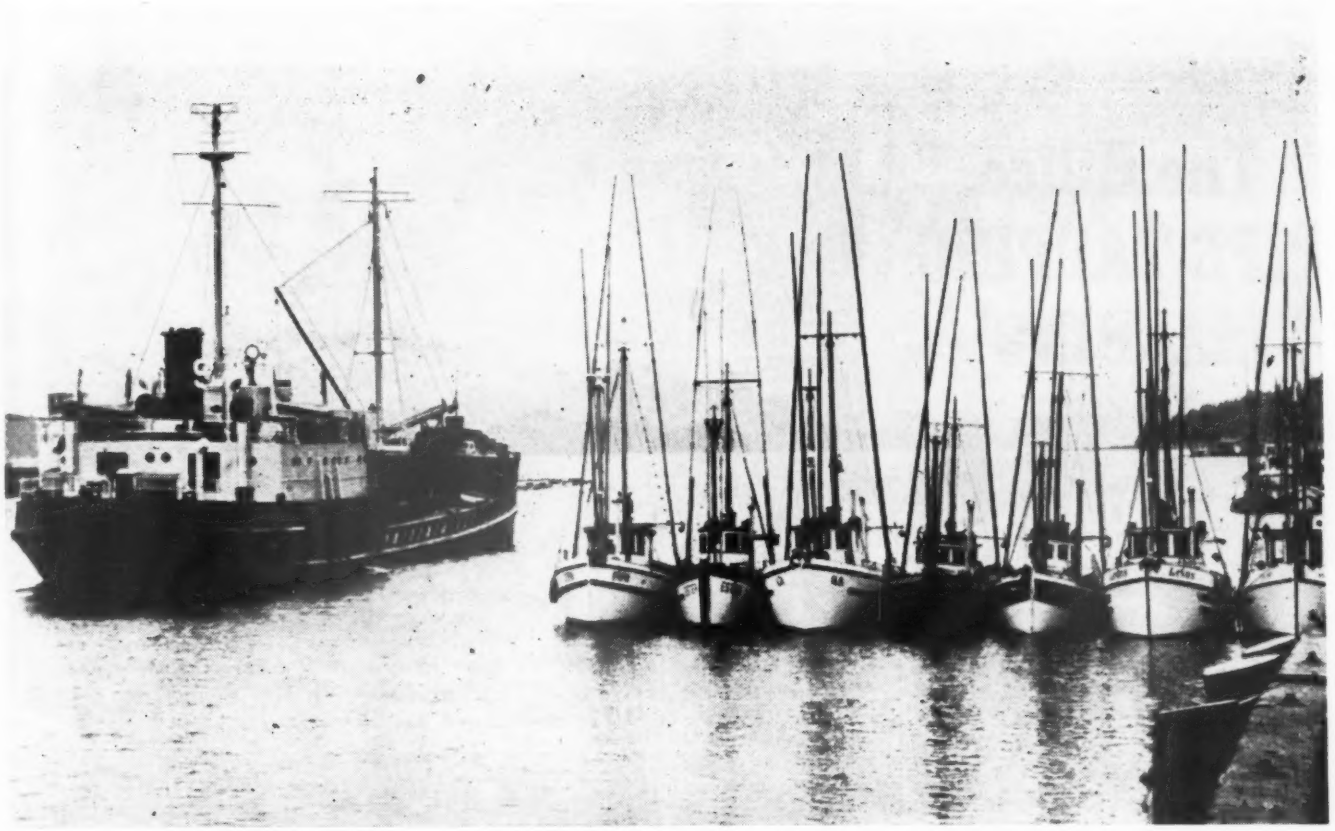
Sniffing the subterranean air is accomplished by a suction from the manifold of the Power Wagon. This suction draws the air up through the pipe in the plow blade, through a dust filter, and finally via a ruber hose into an MSA explosimeter in the cab of the Power Wagon. The explosimeter, as the name implies, is an apparatus for detecting explosive air-gas mixtures. With this new equipment, the pipe line patrolman makes his inspection while sitting comfortably within the cab. All he has to do is watch the dial of the explosimeter attentively as his partner drives along.

Prior to the development of this mechanical tester, the patrolman tested for leaks by walking over the line and taking spot samples at intervals with a spearlike instrument. This he plunged into the earth, and drew his sample by means of a rubber handbulb. It might be mentioned that in operation, the smeller roots into the ground some 14 in., and the entire western section will eventually be tested in this manner. When the terrain becomes too hilly to be negotiated by the power wagon, a caterpillar tractor will draw the plow. * * *

Above is a photo that demonstrates how the leak detector is hooked up to Power Wagon. The entire western section of the Biggest Inch line is to be tested with the device.

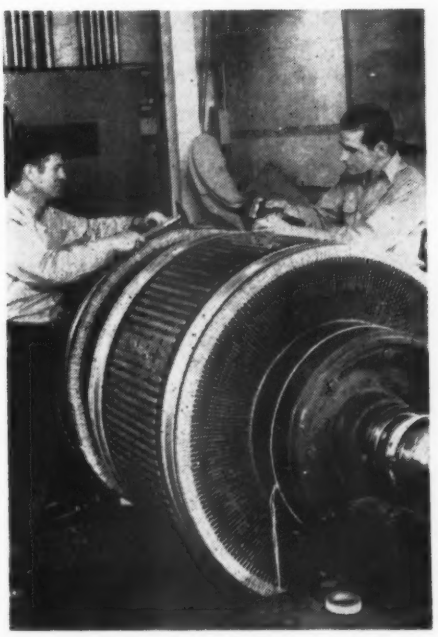
Here Maxwell Orr is shown with the explosimeter carried in the truck. The hose leading from the rear end can be seen at right. The photo on the right shows the hose attached to the detector.

Harry Gavin, left, and Orr, inspect active end of mechanical smeller. Plow cuts furrow along trench backfill, sampling air in the ground as it goes. Air is sucked through hose into explosimeter, which indicates presence of gas.



The Alaska Standard leaving Sitka. A ship-to-shore radio simplifies and speeds deliveries. A control rheostat gives "pilot house control" of tanker's G-E diesel-electric propulsion.

Alaska Standard Has First Major Overhaul in 24 Years



Wood wedging on two 300-hp armatures before soldering armature bars to commutator risers.

BACK in service again after its first major overhaul in 24 years of supplying southeastern Alaskan ports with petroleum products, the *Alaska Standard* has been stepped up both in speed and power. The original electric propulsion equipment, which powered the ship through nearly a million nautical miles of service, has undergone a complete overhaul and reconditioning in General Electric's San Francisco Service Shop.

The unusual 210-ft "floating service station," one of the best known and most popular of ships in Alaskan waters, has been keeping families and industries of the area in heat, light, and power since commissioned in 1923.

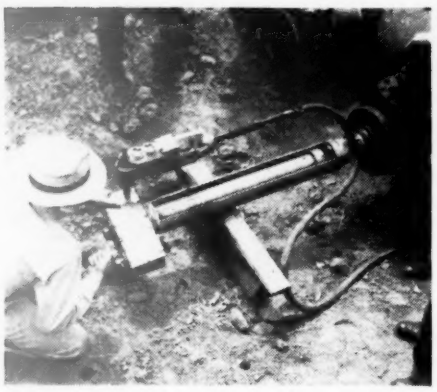
Large supply depots have been established at Juneau, Ketchikan, Seward, and Dutch Harbor by Standard Oil of California, but the single-screw *Alaska Standard* is the "peddler" that provides the personalized service to many Alaskan ports and canneries.

Supplying Alaskan petroleum users is not a simple task. The seafood canneries that line the coast use large quantities and various types of petroleum products for continuous operation during fishing seasons. Fishing boats keep their engines turning over day and night without stop when the salmon are running, and oil stoves are often in use for months at a time during the long Arctic winter. Trucks pushing forward over the Alaska and Richardson highways need gasoline and diesel fuel. On top of these vital needs is the constant demand for special fuel for pressure lanterns, fly sprays, starting fluids, greases, and rust preventives. All are part of the *Alaska Standard's* stock in trade on its regular trips into the bays and inlets. They are sold on the dock to the fishermen, trappers, storekeepers, and missionaries by the oil salesman who travels on the tanker in the summer.

After nearly a quarter of a century of this service, the *Alaska Standard*, powered by diesel-electric drive, recently put into the Moore Drydock

Announcing . . .

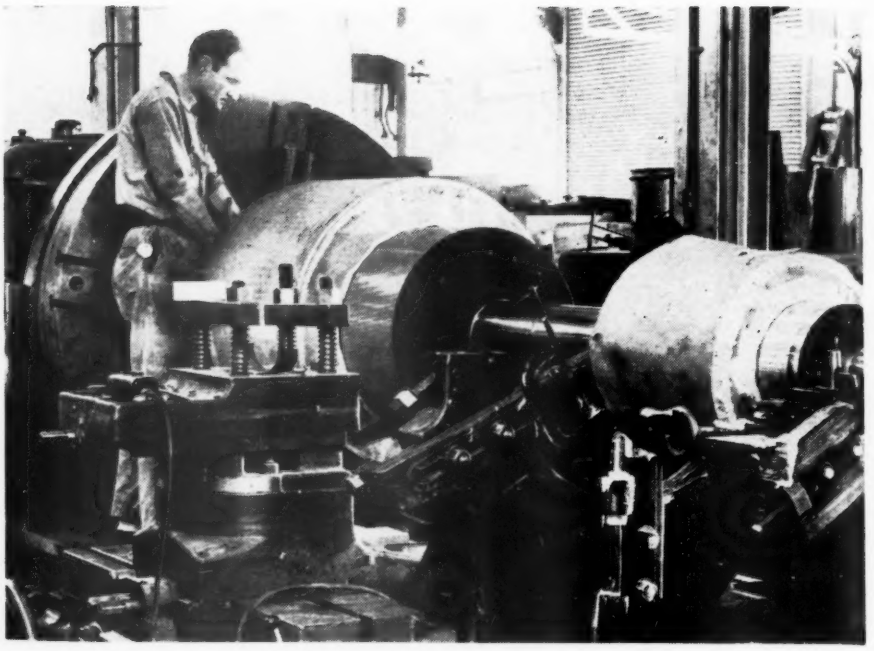
The Hillco PIPE TAPPING MACHINE*



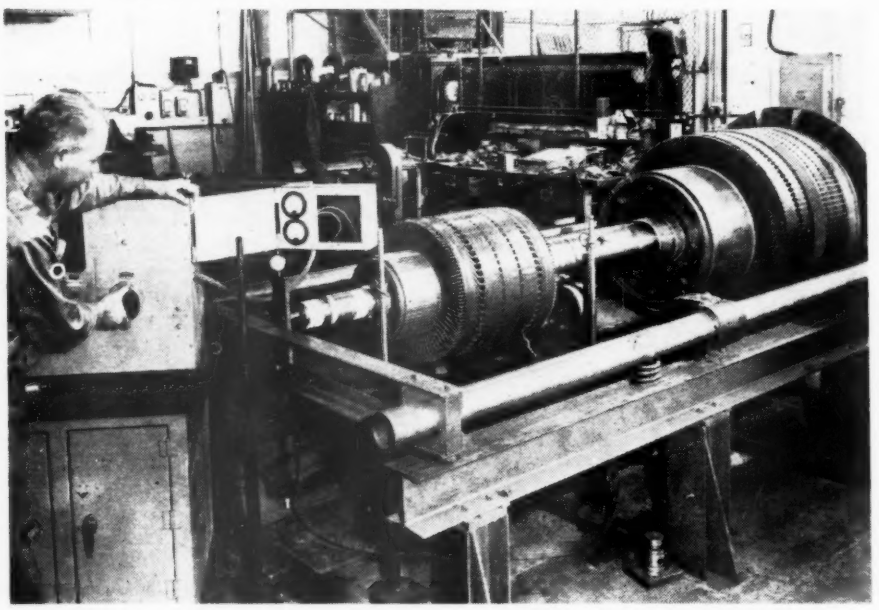
The HILLCO PIPE TAPPING MACHINE is the FIRST absolutely dependable machine for making taps into high pressure pipe lines and storage vessels . . . QUICKLY and EASILY.

For Complete Information Write . . .

*Patent No. 2,097,398
Other Patents Pending



Setting up, in 60-in. lathe, to turn and grind commutators for generator and exciter. Below, dynamically balancing combined generator and exciter armatures as a unit.



Company at Oakland, California, for its first major overhaul. G-E marine service engineers went aboard to supervise reconditioning of its two 245-kw, d-c generators, two 300-hp motors and other electrical equipment.

Motors and generators were removed and sent to the G-E Service Shop where they were dismantled and the generator shafts removed. Propulsion armatures were cleaned, rewound, rebanded, and modified to increase speed and horsepower (265 to 315 rpm). The armatures were then dipped, baked, and pressed on new shafts and dynamically balanced. Coils were stripped, cleaned, rewound, and reinsulated with mica-glass. Copper bars were cleaned and retaped, the commutators were turned and polished, and the slots were undercut. Brush holders were reinsulated and chemically cleaned. New collars were installed on field and commutating coils and sprayed with Glyptal lacquer.

On board the ship, marine service engineers cleaned and completely overhauled the propulsion switchboard and field rheostats. When the motors and generators were reassembled they were lowered back into place through the engine room hatch.

Dock trials and sea trials were passed with flying colors and with a final swing to square away its compass, the *Alaska Standard* headed back into the Arctic to continue its vital service. * * *

WITH THE

Pipe Line Contractors

Latex Construction Company, Houston, Texas, is now engaged in the construction of 60 miles of 16-in. crude oil line for The Texas Pipe Line Company from East Houston to West Columbia, Texas. Work began late in September. F. A. Silar is superintendent; W. A. Briley, assistant superintendent; C. V. Oliver and J. J. Nolan, office. Present headquarters are Houston, Texas.

For Stanolind Pipe Line Company the company is laying 55 miles of 16-in. crude oil line in the vicinity of Hollis, Oklahoma. Approximately 35 miles had been completed to September 20 with the project expected to be finished by October 1. E. C. Norris is superintendent; J. A. Williamson, assistant superintendent; Ralph Axsom, office manager; headquarters, Altus, Oklahoma.

In eastern Alabama and Georgia 60 miles of 24-in. loop lines are being laid for the Southern Natural Gas Company. Approximately 28 miles had been completed late in September and work was progressing on schedule. W. H. Hayes, superintendent; M. L. Thompson, assistant superintendent; Paul Dakin, office manager; headquarters, Anniston, Alabama.

On 140 miles of 6-in., 8-in., and 10-in. take-up and yard reconditioning for The Texas Pipe Line Company from Humble to Port Arthur, Texas, work is under way. H. L. Leake is in charge of take-up; Sam Harrison, office; H. E. Murphy in charge of rack; E. L. Peterson, office; headquarters, Liberty, Texas.

Construction of tank farm piping and manifolds at East Houston tank farm for The Texas Pipe Line Company has been completed except for finishing up details. H. E. Murphy, superintendent; A. E. Stremmel, office manager; headquarters, Houston, Texas.

Construction of tank farm piping, pump station, and manifolds for The Texas Pipe Line Company at West Columbia, Texas has started. J. B. Latham, superintendent; W. E. Bayles, office manager; headquarters, West Columbia, Texas.

Construction of tank farm piping and manifolds for The Texas Pipe Line Company at Port Arthur and Port Neches, Texas, was almost completed late in September. J. A. Cantrell, superintendent; J. B. Stoddard, office manager; headquarters, Nederland, Texas.

Sheehan Pipe Line Construction Company, Tulsa, Oklahoma, at the present time is working on 40 miles of 24-in. gas line for the Southern Natural Gas Company. The work is in four loops, 33 miles of the line being in Mississippi and 7 miles in Alabama. Fifteen miles have been completed to date. (September 18).

The company also is laying 110 miles of 12-in. crude line for the Buckeye Pipe Line Company, starting at Cygnet, Ohio, and continuing to Cleveland, Ohio. Approximately 70 miles have been completed (September 18). Offices are in Grafton, Ohio.

Work began the week of September 20 on the Cast Iron Water System for the Ohio Oil Company's refinery at Robinson, Illinois.

Vaughn & Taylor Construction Company, Inc., Wichita Falls, Texas, is now engaged in constructing a 90-mile gathering system for Phillips Petroleum Company near Guymon, Oklahoma, (Sherman field lines), including 40 miles of 24-in. About 5000 ft are being laid daily. The job is under the supervision of D. D. Vaughn.

The company also has about one month's field work for Shamrock Oil and Gas Corporation near Dumas, Texas. The superintendent is R. L. Taylor.

Trojan Construction Company, Oklahoma City, Oklahoma, has two jobs under way, one 36 miles of 12-in. pipe for Oklahoma Natural Gas Company with the starting point at Ninnekah, Oklahoma, and terminus at Maysville, Oklahoma. Approximately 50 per cent of this work has been completed. The other line is 71 miles of 16-in. for the same company starting at Maysville and ending at Holdenville, Oklahoma. Approximately 60 per cent of this line has been completed.

Lines also to be started for Oklahoma Natural are 8 miles of 18-in. and 1½ miles of 16-in. beginning December 1 in Muskogee County and ending about December 15 in Okmulgee County. Thirty-one miles of 12-in. is to be started October 15 at Maysville and ended at Velma, Oklahoma by December 1.

H. C. Price Company, Pipe Line Division, Bartlesville, Oklahoma, is currently engaged in the following projects:

Natural Gas Pipeline Company of America—General contract covering construction of 54 miles of 24-in. main line loop and two multiple-line river crossings from Geneseo to La Salle, Illinois. The field construction office is at Geneseo, Illinois. R. K. Shivel is superintendent and Roy E. Burgess is office manager. Approximately 52 miles had been completed on September 22. Other key personnel: Foremen: J. D. White, W. H. Olrich, J. H. Latham, C. E. Shivel, R. L. Ezell, U. M. Beaver, G. E. Beaver, and S. L. Price.

Southern Natural Gas Company—General contract covering construction of 35 miles of 24-in. pipe line loop near Birmingham, Alabama. The field construction office is at Bessemer, Alabama. W. B. Williams is superintendent and P. O. Rutledge is office manager. Approximately 15 miles had been completed on September 22. Other key personnel: Foremen: John Hamilton, K. K. Kelly, J. I. Cobb, C. F. Jones, R. Owens, A. D. Hamilton, and R. H. Edwards.

Tennessee Gas Transmission Company—General contract covering construction of 205 miles of 30- and 31-in. pipe line loops from El Campo, Texas, to Natchitoches, Louisiana. H. C. Price Company and Bechtel Corporation are constructing this pipe line as a joint venture. Two H. C. Price Company spreads are in operation. The first on Section A loop extending 79 miles northeast of El Campo, Texas, is under the supervision of J. E. Ellis, with head-

quarters at Wharton, Texas. Approximately 32 miles had been completed on September 22. Key personnel: Ray Stokes, A. M. Wimberly, Clifford Simmons, J. E. Hamilton, R. C. Shivers, N. B. Edmonds, Kenneth Adkins, C. L. Stewart, M. E. Stevens and S. O. Donaldson. The second spread on Section C, consisting of a 55-mile loop extending southwest of Natchitoches, Louisiana, began operations during the first part of September. G. A. Reutzel is superintendent, with field construction office in Natchitoches. Approximately 14 miles had been completed on September 22. Key personnel: Eddie Yount, J. A. Hairston, Lloyd Loncarich, J. C. Anderson, H. C. Morrison, R. W. Orr, S. J. Wood, Athel Bell, and T. E. Walker.

The Somastic Division of H. C. Price Company reports on the following work:

Buckeye Pipe Line Company—Contract made early in 1948 for the application of Somastic coating to approximately 82 miles of 22-in. OD pipe that will be laid from Lima to Toledo, Ohio. Somastic plant is now at Lima, Ohio, and coating will begin early in October.

Buckeye Pipe Line Company and Standard Oil Company—Application of coating to approximately 120 miles of 12¾-in. OD pipe, which is being laid from Cygnet to Cleveland, Ohio. Plant coating was completed on this project during September. The field work will be completed in October. W. G. Glenn is project superintendent, and C. R. Murphy, office manager. Their headquarters are at Wakeman, Ohio.

Socony-Vacuum Oil Company, Inc.—Order received during March covering application of coating to 119 miles of 6⅝-in. OD pipe for a products line to be laid from Portland to Bangor, via Augusta, all in Maine. Hugh Clements is project superintendent and M. Anderson, office manager. Headquarters are at Freeland, Pennsylvania.

Stanolind Oil and Gas Company—Contract for application of Somastic coating and stringing of 320 miles of pipe, ranging in size from 2-in. to 30-in. OD, which will be used in construction of a gasoline plant gathering and residue system in the Slaughter pool area near Levelland, Texas. William Bauer is project superintendent, and E. L. Rensch is office manager. Headquarters are at Sundown, Texas.

Susquehanna Pipe Line Company—Application of coating for approximately 12 miles of 8⅝-in. OD pipe to be laid in Michigan. W. G. Glenn, project superintendent; C. R. Murphy, office manager; headquarters, Wakeman, Ohio.

Philadelphia plant operations are as follows:

Consolidated Edison Company—Somastic coating and interior cleaning and coating of approximately 7000 ft of 8⅝-in. OD pipe. Also Somastic coating and interior coating of 96,500 ft and interior and exterior coating of 10,500 ft of 8⅝-in. pipe.

Phelps Dodge Corporation—Somastic coating of 42,500 ft of 5½-in. OD pipe and 3520 ft of 6-in. OD pipe.

Sinclair Refining Company—Contract received in June for the application of Somastic coating to approximately 28 miles of 8⅝-in. OD pipe, which will be used for transportation of petroleum products from Sinclair's Chelsea pump station to its Philadelphia terminal.

Texas Eastern Transmission Corporation—Somastic coating of 27 miles of 6, 8, and 12-in. pipe, which will be used in the construction of a gas distribution system.

Philadelphia plant key personnel consists of E. Rowland English, manager; M. J. Lane, superintendent; James E. Kepple, engineer; J. E. Sponeybarger, foreman: V. J. Jones, reclamation foreman; T. L. Huitt, office manager.

Continued on Page 357

Grip-Tite Stearns Pipe Line Anchor Assembly

Top view showing large area of bearing surface on coating. Pipe saddle made of 10 gauge sheet steel. Hot dip galvanized after stamping.

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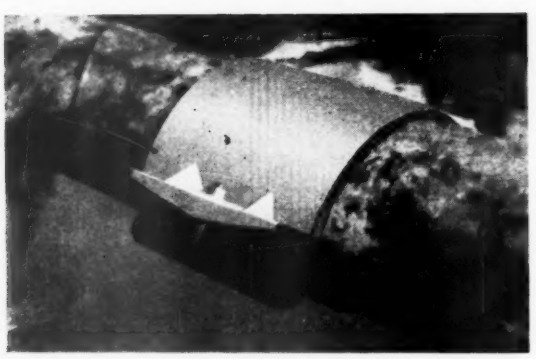

Grip-Tite Pipe Line Anchor Assembly with Stearns Pipe Saddle was originated and designed especially for protection to pipe coating and for permanent holddowns for all kinds of pipe line construction, costing only a fraction of cast iron or concrete weights. It is field proved beyond any doubt. No heavy equipment is needed for installation—saves time, labor and other handling expense. Grip-Tite affords protection from heavy weight damage during installation. An expansion joint pad provides additional protection to pipe coating.

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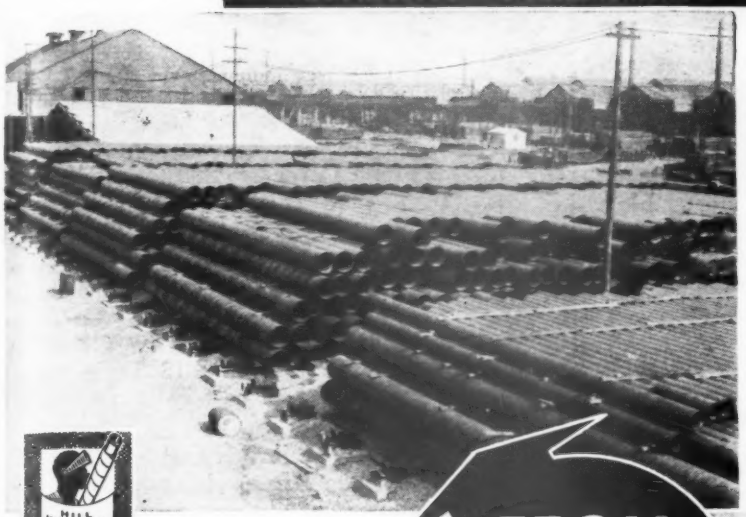

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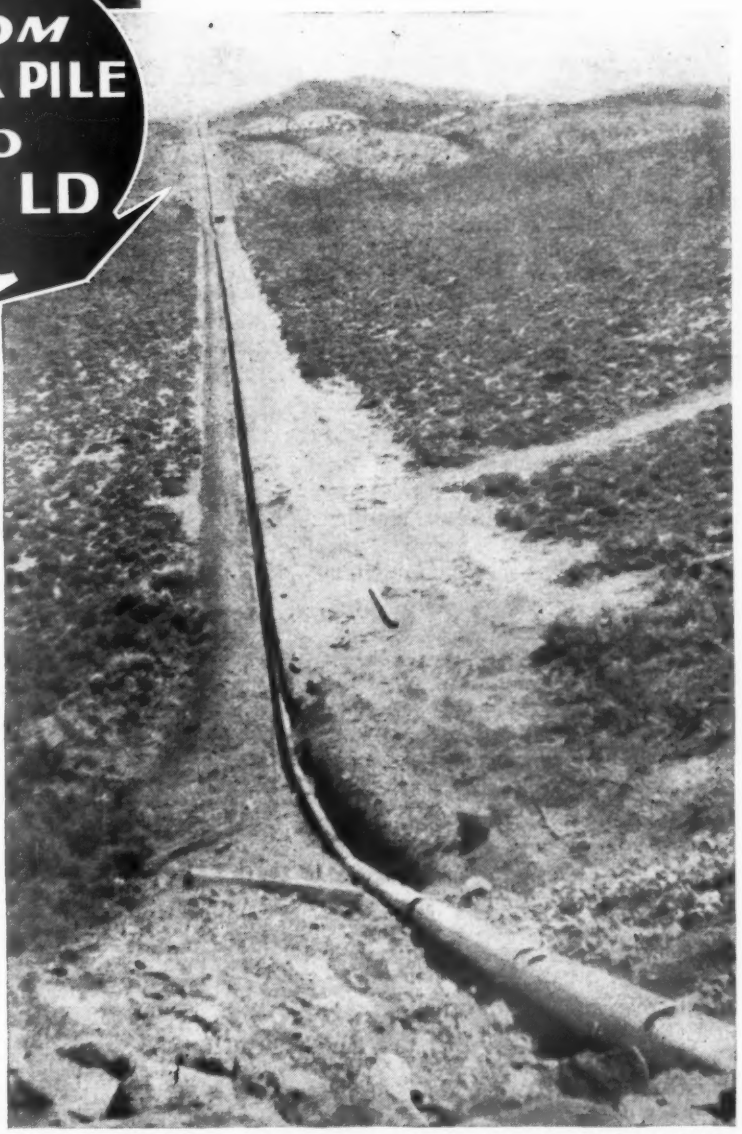

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▸ **Ford, Bacon & Davis, Inc.,** engineers and constructors of New York City, announces as its principal pipe line job the work it is doing on the Michigan-Wisconsin Pipe Line Company 24-in. line from the Texas Panhandle to Detroit and Milwaukee. The length of the line with branches is about 1800 miles. Currently about 300 miles have been laid.

The company also has under way considerable miscellaneous pipe line work for Southern Natural Gas Company consisting principally of main line looping. On some of this work the company is acting as supervising engineers and some sections are being constructed by its crews. At Pickens, Mississippi, 5 miles of 24-in. is being laid; at Center Ridge, Mississippi, 16 miles of 24-in.; at Brooksville, Mississippi, 12 miles of 24-in.; at Reform, Alabama, 7 miles of 24-in.; at Mulga, Alabama, 36 miles of 24-in.; at Pell City, Alabama, 14 miles of 24-in.; at Eastabaga, Alabama, 12 miles of 24-in.; at Heflin, Alabama, 21 miles of 24-in., and at Carrollton, Georgia, 14 miles of 20-in. In addition, 23 miles of 4-in. and 8-in. are being laid at two other locations.

Also for Southern Natural the following additions are being made to compressor stations: Louisville, Mississippi, 8000 hp; Reform, Alabama, 7000 hp; Tarrant, Alabama, 1000 hp; De Armandville, Alabama, 3000 hp; Rankin, Mississippi, 5000 hp, and McConnell, Georgia, 2000 hp. Alterations are being made at compressor stations at Ben Hill, Georgia; Kemper, Uetumpka, and Selma, all in Alabama.

▸ **Williams Brothers Corporation,** Tulsa, Oklahoma, has been working two spreads on the 20-in., 84-mile line for East Ohio Gas Company between Switzerland Township and Jackson Township. The contractor also has a job for United Natural Gas Company, consisting of 100 miles of 12-in., 20-in., and 22-in. This job includes laying new pipe, taking up and relaying old. The crews are working out of Kane, Pennsylvania.

Within the city limits of Minneapolis, 20 miles of 12-in., 16-in., and 20-in. pipe is being laid for Minneapolis Gas and Light Company. A short job, 12 miles of 12-in. between New Kensington and Glenshaw, Pennsylvania, is under way for Peoples Natural Gas Company.

▸ **Williams Brothers Overseas Corporation,** Tulsa, Oklahoma, is nearing completion of the 155-mile, 24-26-in. Creole Petroleum Company pipe line being laid from Ule tank farm to La Salina-Amuay Bay, Paraguana, Venezuela. The contractor also has under way a 6-in., 255-mile line for Yacimientos Petroliferos Fiscales Bolivianos, from Camiri to Cochabamba to Sucre. Both of these are crude oil lines.

For Petroleos Mexicanos a 20-in., 150-mile natural gas line is being constructed from Poza Rica to Mexico City.

▸ **Midwestern Constructors, Inc.,** Tulsa, Oklahoma, has recently been awarded a contract by Panhandle Eastern Pipe Line Company for the construction of several 26-in. loops. At Centralia, Missouri, the loop will consist of 15 miles of pipe; at Pleasant Hill, Missouri, 10.8 miles, and at Glenarm, Illinois, 17.1 miles. A 24-in. crossing of the Sangamon River will be made on the Glenarm installation. The superintendent is M. T. "Bill" Wilhite.

Other jobs include:

General Electric Company, Lamp Department: Installation of 82 storage bottles in Ohio (Circleville, Bucyrus, and Bellevue). Frank E. Everett, Jr., Bellevue, Ohio, is superintendent.

Ohio Fuel Gas Company: 40 miles of 20-in. near Sugar Grove, Ohio. This job has been delayed considerably by excessive rains. The superintendent is Clyde Peters, who is making his headquarters at Wellston, Ohio.

Socony-Vacuum Oil Company, Inc.: Construction of 155 miles of 8-in. from Malvern, Pennsylvania, to Binghamtom, New York. Lacy Walker is superintendent. The field office is at 842 Hamilton Street, Allentown, Pennsylvania.

Shell Pipe Line Corporation: Relocation of lines at Chain and Rocks Canal, Wood River, Illinois. The field office is at Edwardsville, Illinois, with Earl S. Powell as superintendent.

Panhandle Eastern Pipe Line Company: Installation of additional facilities at Liberal, Hugoton, and Satanta, Kansas, compressor stations. J. A. Bard, superintendent; field office, Liberal.

▸ **R. B. Potashnick,** general contractor, Cape Girardeau, Missouri, is working on three loops in Kansas and Nebraska for Stanolind Pipe Line Company. The total mileage is 65, of which 35 miles had been completed September 23. The size of the pipe is 16 in. Garland L. Mims is the spread man.

This company also is just beginning a job in Missouri for the Panhandle Eastern Pipe Line Company. The work consists of two loops totaling 44 miles of 26-in. pipe. The spread man is Roy C. Whitworth.

▸ **Oklahoma Contracting Company,** Dallas, Texas, has just completed laying 45 miles of 24-in. pipe at Milton, West Virginia, for Tennessee Gas Transmission Company, and 45 miles of 24-in. at Charleston, West Virginia, for the same company. No other jobs are on schedule at the moment.

▸ **Bechtel Corporation,** San Francisco, California, is constructing 78 miles of 30-in. and 31-in. line for Tennessee Gas Transmission Company, from Fairdale to Splendora, Texas.

▸ **J. R. Horrigan Construction Company,** Houston, Texas, is working on 450 miles of 24-in. from Hansford County, Texas, to Marysville, Missouri, for Michigan-Wisconsin Pipe Line Company. This is the initial construction on the 1548-mile project that is scheduled for completion July 1, 1950.

▸ **Ray L. Smith and Son, Inc.,** Eldorado, Kansas, is constructing 184 miles of 26-in. line for Cities Service Gas Company between Ulysses and Hutchinson, Kansas. This is part of Cities Service's 405-mile line between Ulysses and Kansas City. The entire line will not be laid in 1948.

The contractor is also doing a 45-mile, 16-in. takeup at Oswego, Kansas, for Cities Service.

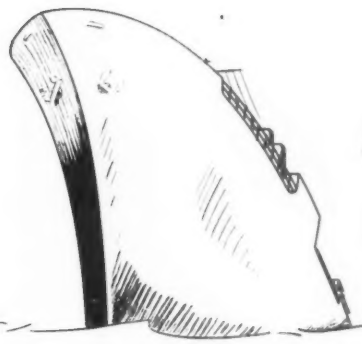
▸ **Smith Contracting Corporation,** Fort Worth, Texas, is laying a 20-mile, 10-in. line from Wheeler to Wink, Texas, for Shell Pipe Line Corporation. From Wheeler to Wasson, Texas, a 81-mile, 10-in. and 12-in. extension is under way for Stanolind Pipe Line Company. For The Texas Pipe Line Company, 173 miles of 24-in. is being constructed between Wichita Falls, Texas, and Cushing, Oklahoma. This is a part of the Basin Pipe Line System from Jal, New Mexico, to Cushing. Near Carnegie, Oklahoma, 51 miles of 16-in. is being laid for Stanolind.

▸ **O. C. Whitaker Company,** Fort Worth, Texas, has in progress for Stanolind Pipe Line Company 73 miles of 8-in. and 10-in. line between Steamboat and Lost Cabin, Wyoming, and 35 miles of 12-in. between Arminto and Casper Creek, Wyoming. Near Guthrie, Oklahoma, the company is laying 50 miles of 16-in. for Stanolind.

▸ **R. H. Fulton and Company,** Lubbock, Texas, has completed 60 per cent (October 3) of the 39 miles of 16-in. pipe being laid for Stanolind Pipe Line Company near Douglas, Wyoming. Near the same point and for the same company work is beginning on 23 miles of 12-in. Also just beginning for Stanolind at Douglas is a take-up and reconditioning job consisting of 51 miles of 8-in. and 12-in. pipe.

The company has received a contract from Panhandle Eastern Pipe

Continued on page 357



MARINE OPERATIONS

Shipbuilders Council reports 61 tankers under construction

United States private shipyards, September 1, had on order or under construction 72 vessels of 1000 gross tons or over, according to the Shipbuilders Council of America. The report includes 61 tankers, aggregating 984,180 gross tons or 1,554,300 deadweight tons. Scheduled for 1948 delivery are one tanker in October and two tankers in December. The delivery schedule for 1949 includes 31 tankers. One tanker is for 1951 delivery. .

Tanker contracts on hand as of September 1, 1948.

Name of plant	Name of vessel, Hull No.	Length BPP, ft	Speed	Gross tons	Dead-weight tons	Owner	Scheduled delivery date
Beth.—Quincy	1607	595	16	17,500	28,000	Texas Company	July 1949
	1608	595	16	17,500	28,000	Texas Company	Aug. 1949
	1609	595	16	17,500	28,000	Texas Company	Sept. 1949
	1610	595	16	17,500	28,000	Texas Company	Oct. 1949
	1611	595	16	17,500	28,000	Foreign	Dec. 1949
	1613	595	16	17,500	28,000	Atlas Tankers	Jan. 1950
	1614	595	16	17,500	28,000	Atlas Tankers	July 1950
	1615	595	16	17,500	28,000	Atlas Tankers	Sept. 1950
	1616	595	16	17,500	28,000	Atlas Tankers	Oct. 1950
	1617	595	16	17,500	28,000	Atlas Tankers	Dec. 1950
Beth.—Spar. Pt.	S/S Olympic Games	524	15½	10,700 L	18,000	Foreign	Dec. 1948
	4464	524	15½	10,700	18,000	Atlantic Maritime of Panama	Jan. 1949
	4465	524	15½	10,700	18,000	Atlantic Maritime of Panama	Feb. 1949
	4466	524	15½	10,700	18,000	Foreign	Mar. 1949
	4467	595	16	17,500	28,000	Gulf Oil	May 1949
	4468	595	16	17,500	28,000	Gulf Oil	June 1949
	4469	595	16	17,500	28,000	Foreign	Aug. 1949
	4470	595	16	17,500	28,000	Gulf Oil	Dec. 1949
	4471	595	16	17,500	28,000	Gulf Oil	Jan. 1950
	4472	595	16	17,500	28,000	Olympic Oil	Sept. 1949
	4473	595	16	17,500	28,000	Panama	Nov. 1949
	4474	595	16	17,500	28,000	Panama	Mar. 1950
	4475	595	16	17,500	28,000	Panama	May 1950
	4476	487-6″	15	9,800	16,500	A.-C. Tankers	Sept. 1949
	4477	487-6″	15	9,800	16,500	A.-C. Tankers	Feb. 1950
	4478	487-6″	15	9,800	16,500	A.-C. Tankers	July 1950
	4479	487-6″	15	9,800	16,500	A.-C. Tankers	Aug. 1950
	4480	595	16	17,500	28,000	Foreign Tankship	June 1950
	4481	595	16	17,500	28,000	Foreign Tankship	Sept. 1950
	4482	595	16	17,500	28,000	Foreign Tankship	Oct. 1950
	4483	595	16	17,500	28,000	Foreign Tankship	Dec. 1950
	4484	595	16	17,500	28,000	Foreign Tankship	Feb. 1951
ngalls S/B Co.	526	385	11½	4,300	8,300	Texas Company	Mar. 1949
Newport News S/B & D/D Co.	475	600	16	17,000	26,000	Standard, N. J.	April 1949
	476	600	16	17,000	26,000	Standard, N. J.	June 1949
	477	600	16	17,000	26,000	Standard, N. J.	July 1949
	478	600	16	17,000	26,000	Standard, N. J.	Sept. 1949
	479	600	16	17,000	26,000	Atlantic Mar. Co.	Oct. 1949
	480	600	16	17,000	26,000	Standard, N. J.	Nov. 1949
	481	600	16	17,000	26,000	Standard, N. J.	Jan. 1950
	482	600	16	17,000	26,000	Standard, N. J.	Feb. 1950
	483	600	16	17,000	26,000	Standard, N. J.	April 1950
	484	600	16	17,000	26,000	Standard, N. J.	May 1950
	485	600	16	17,000	26,000	Standard, N. J.	June 1950
Sun S/B & D/D Co.	566	600	16	17,000	26,000	Standard, N. J.	Dec. 1948
	568	600	16	17,000	26,000	Standard, N. J.	Mar. 1949
	567	600	16	17,000	26,000	Gulf Oil	Feb. 1949
	569	600	16	17,000	26,000	Gulf Oil	May 1949
	570	600	16	17,000	26,000	Tanker Nav.	June 1949
	571	600	16	17,000	26,000	Tanker Nav.	July 1949
	572	600	16	17,000	26,000	Tanker Nav.	Sept. 1949
	573	600	16	17,000	26,000	Tanker Nav.	Oct. 1949
	574	600	16	17,000	26,000	Tanker Nav.	Dec. 1949
	575	600	16	17,000	26,000	Tanker Nav.	Jan. 1950
	576	600	16	17,000	26,000	Tanker Nav.	Mar. 1950
	577	600	16	17,000	26,000	Sun Oil	June 1950
	578	600	16	17,000	26,000	Sun Oil	Aug. 1950
	579	600	16	17,000	26,000	Standard, N. J.	
	580	600	16	17,000	26,000	Standard, N. J.	
Welding Shipyard	24	615	18	17,940	30,000	Nat. Bulk Car	Oct. 1948
	25	615	18	17,940	30,000	Nat. Bulk Car	Jan. 1949

L–Launched.

Modernizing program for tugboat fleet

A program for modernizing and rehabilitating its tugboat fleet, including acquisition of a new vessel, is announced by the Socony-Vacuum Oil Company, Inc.

A net effect of the program, according to Frederic R. Pratt, manager of the company's Marine Transportation Department, will be an increase in the fleet's total horsepower, with no vessel having less than 900 hp.

The Socony-Vacuum tugs are used principally in New York harbor, Long Island Sound, the Hudson River, and coastwise between Philadelphia and New York.

Costing slightly in excess of $300,000, the new tug is entirely of steel. It was constructed by the Gulfport Shipbuilding and Repair Company at Port Arthur, Texas, and was delivered in Port Arthur early in September.

This tug has an overall length of slightly more than 102 ft, a beam of 24 ft, and a molded depth of 12 ft, 4 in. Equipped with a diesel engine, it has 1000 hp at the shaft and is powered by a straight gear drive. Quarters for a crew of 11 are provided. It has a towing speed of seven knots.

In addition, the new tug is equipped with a radio-telephone for ship-to-shore communication and a radio direction finder.

Two vessels in the Socony-Vacuum tug fleet will be converted from steam to diesel with 1000-hp at the shaft, compared with 600-hp steam engines with which the tugs are now equipped. The conversion will begin about January 1.

Open New York office

Texas Coast Shipyards, Galveston, Texas, has announced establishment of a New York office at 56 Beaver Street with George L. McInnes, marine engineer and surveyor, as manager.

McInnes, who is also president of McInnes Corporation, during the war years was in charge of various phases of construction, repair, and conversion of merchant ships built in American yards for the British government.

New tankers scheduled for Far East service

Long-term charter arrangements covering four large tankers that are still in the drawing-board stage are announced by Standard-Vacuum Oil Company. The vessels, to be built during the next two years, will add more than a half-million bbl of cargo capacity to the Stanvac fleet and will be used in transporting petroleum products to Far East markets.

The tankers will be built at the Bethlehem-Sparrows Point shipyard in Maryland beginning immediately. Each will be of 16,500 dwt, with an over-all length of 487 ft, 6 in. and molded beam of 68 ft. They will draw less than 30 ft of water when in ballast.

Similar in size to the war-time T-2 type vessels, the new boats will be powered by geared high pressure steam turbines capable of developing 7700 shaft hp, and will be designed to do a minimum of 15½ knots during their trial runs.

In announcing that Standard-Vacuum had contracted to charter the boats for a period of 15 years, W. F. Dunning, manager of marine operations, stated that this addition to the company's tanker facilities in the Orient should help to ease the pressure on presently available tankers needed for crude oil and product movements in the Western Hemisphere and to European ports. The necessity for providing additional tonnage for growing Far Eastern market requirements is already urgent, he said.

Bulk terminal progresses

Socony-Vacuum Oil Company's new terminal, storage, power, and other facilities at Port Socony, Staten Island, is more than half completed, it has been announced.

Increased tanker orders placed with Bethlehem

Orders for 18 more super-tankers, valued at $110,000,000, have been received by Bethlehem Steel Company, for construction at its Sparrows Point (Md.) yards. Increased volume will make it necessary for Bethlehem to step up employment from 3000 to 4000, it is announced.

Most of the new tankers will be bought by domestic oil companies; others will be chartered by them. Fourteen of them will be 28,000 deadweight tons (carrying capacity). High-speed tankers built as Navy auxiliaries during the war were 10,000 tons smaller. Four of the new tankers will be 16,500 tons.

With these new contracts in hand, Bethlehem has 530,000 tons of tankers underway.

Standard Oil Company of New Jersey orders eight more super-tankers

Negotiations for construction of eight additional super-tankers with a capacity of 228,000 bbl each have been completed by Standard Oil Company (New Jersey), bringing to 14 the number of such vessels the company has contracted for within the last six months.

Six of the eight tankers will be built by the Newport News Shipbuilding and Dry Dock Company, Newport News, Virginia, and are expected to be completed by July, 1950. The other two will be constructed by the Sun Shipbuilding and Dry Dock Company, Chester, Pennsylvania, with the date for completion in July and August, 1950.

Previously, Jersey Standard contracted for construction of four of the tankers by the Newport News company and two by the Sun Shipbuilding firm. One is scheduled for delivery by the end of this year, three early in 1949, and two the latter half of 1949.

Each of the 14 tankers will have a haulage capacity about 70 per cent greater than the T-2 type tankers built during the war. Their total capacity will aggregate 3,192,000 bbl and their construction, M. G. Gamble, general manager of the company's marine operations, said, will cost more than $75,000,000.

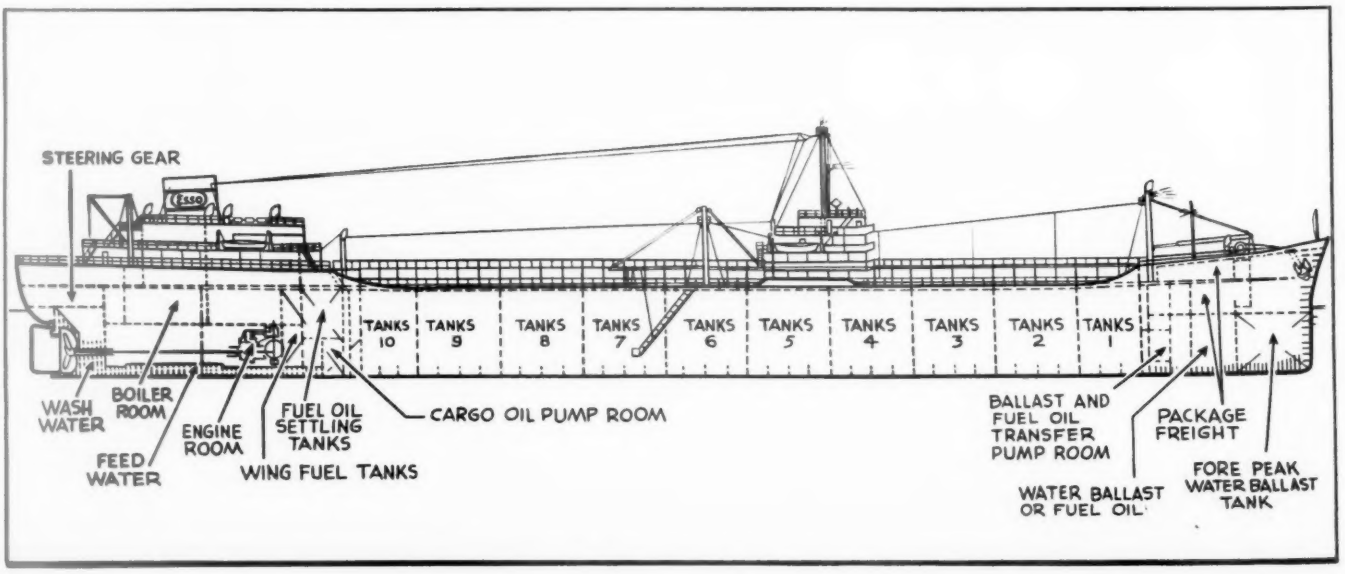
The eight additional tankers, like their sister ships, will have a service speed of about 16 knots and a deadweight of 26,000 tons. Each will be 628 ft overall length and have 82 ft, 6 in. of moulded beam, 42 ft, 6 in. of moulded depth to the upper deck, and 31 ft, 6 in. draft. The normal complement will be about 50 crewmen.

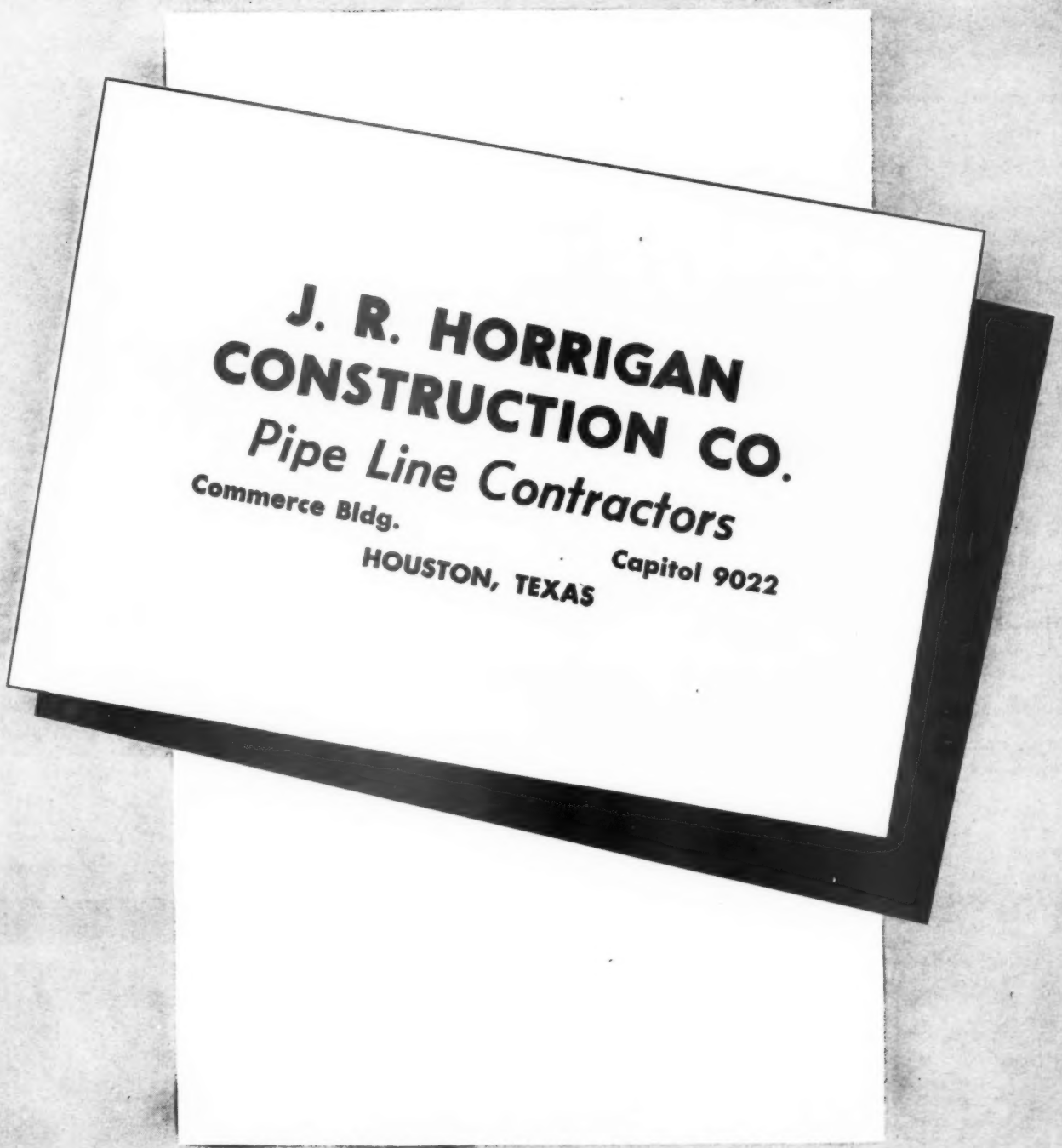
The tankers will be of single deck type with steel welded and riveted construction. Each will have a single screw driven by a high pressure geared steam turbine capable of developing 12,500 shaft hp at 112 rpm.

The new tankers will be capable of entering most ports that can accommodate T-2s with full cargo because their draft will be only about a foot greater.

Addition of the new tankers will raise the total number in the fleet to 145 ships of about 2,400,000 deadweight tons. The company also has 82 special service and Lake type tankers totaling 264,000 deadweight tons.

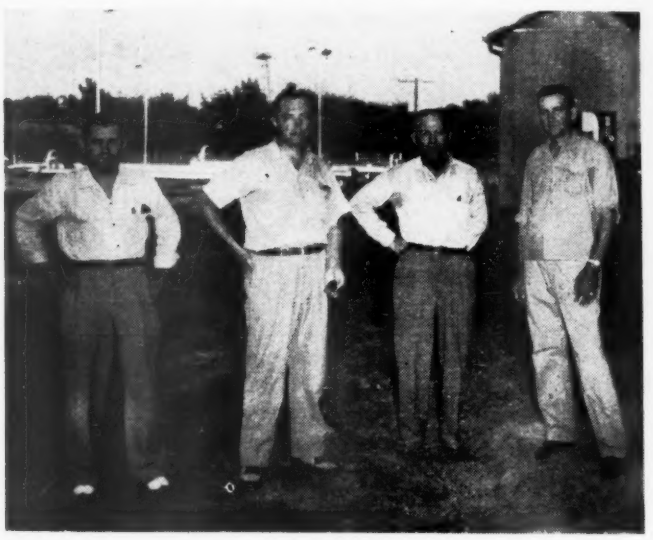
Profile of super-tankers to be constructed for Standard Oil Company (New Jersey)




J. R. HORRIGAN
CONSTRUCTION CO.
Pipe Line Contractors
Commerce Bldg.
Capitol 9022
HOUSTON, TEXAS

PIPE LINE

SS Montebello Hills, constructed by Marinship Corporation and owned and operated by Pacific Tankers, Inc., is a T2-SE-A1 type tanker having a deadweight of 16,600 tons at a draft of 30 ft 2 in. The tanker is presently transporting a cargo of crude oil between the Persian Gulf and the United States East Coast.



Officials and operating men at Bad Creek station, Oklahoma, of Mid-Continent Pipe Line Company. Left to right: Al C. Smith, superintendent of mechanical maintenance; W. E. Bierly, general superintendent; L. C. Lamer, superintendent of telephone and telegraph, and John H. Haney, station engineer-gauger.

An International TD-18 diesel crawler tractor equipped with Superior sideboom lowers section of 20-in. pipe into trench on job by Morrison Bros. Co. near Kermit, Texas, for Sinclair Pipe Line Company.

Easing the 20-in. crude oil line into the river from the ramp barge during the Mississippi River crossing operations on Magnolia Pipe Line Company's pipe line from Corsicana, Texas, to Patoka, Illinois.

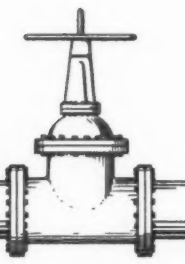
PICTORIAL

Outside new Allen, Oklahoma, pumping station of Sunray Oil Corporation. Richard Lawrence (left), chief station operator, A. L. Smith, station superintendent, and J. R. Ellis, manager Sunray's pipe line department.

At the barbecue that followed the official opening of Magnolia's new pipe line from Corsicana, Texas to Patoka, Illinois. Seated: Bryan Reed, general manager, Chicago division, Socony-Vacuum; Fayette B. Dow, general counsel, NPA and WPRA; and Col J. Monroe Johnson, director, ODT and member of ICC. Standing: Jim Donnell, president, Ohio Oil Company; J. L. Latimer, president, Magnolia Pipe Line and Magnolia Petroleum Company; Clark S. Teitsworth, director and chairman of manufacturing committee, Socony-Vacuum, and Walace Hawkins, vice president and general counsel, Magnolia.

Cleaning machine rides the pipe, suspended by Caterpillar tractor equipped with sideboom, on Basin Pipe Line System, Jal to Cushing. Latex Construction Company was contractor on section where photo was taken.

PIPE LINE



To enlarge Texas-California line

The Federal Power Commission has authorized El Paso Natural Gas Company, Southern California Gas Company, and Southern Counties Gas Company of California to construct and operate additional facilities for the transportation and sale of natural gas.

Construction of the authorized facilities will increase El Paso's daily delivery capacity from 166,000,000 to 246,000,000 cu ft in Texas, New Mexico, and Arizona; from 305,000,000 to 405,000,000 cu ft daily at the California-Arizona boundary for delivery to the Southern California companies, and will permit the sale, for a three-year period, of 17,000,000 to 31,000,000 cu ft per day to the West Texas Gas Company. The additional gas available in Arizona permits service to the cities of Yuma and Nogales. El Paso expects to begin construction of the facilities immediately and to complete them by October 1, 1951. Deliveries of the 80,000,000 cu ft daily in Arizona, New Mexico, and Texas would begin not later than January 1, 1950, the company said.

The facilities authorized include approximately 450 miles of 30-in. transmission loop line paralleling a portion of the present 26-in. pipe line from Lea County, New Mexico, to the Colorado River near Blythe, compressor facilities with an aggregate of 70,900 hp, additional branch transmission lines, gathering lines, and appurtenant facilities. Cost of the project is expected to approximate $56,000,000.

The Southern California companies were authorized to construct and operate approximately 88 miles of 30-in. pipe line to loop in part its existing line from the California-Arizona boundary near Blythe to the Los Angeles area; to build about 15 miles of 30-in. line extending from a point on the Texas-to-California line near Rivira, California, to an existing measuring and regulating station at Slauson Boulevard and West Avenue in Los Angeles; and to add units totaling 4000 hp to its compressor facilities. Cost has been estimated at $10,040,000. The construction would increase the capacity of the two companies' Los Angeles line from 305,000,000 to 405,000,000 cu ft daily in order that they can transport to their markets the additional 100,000,000 cu ft daily to be received from El Paso near Blythe. The California companies expect to complete construction so that deliveries can be commenced not later than October, 1951.

Argentina crude oil line

Construction of a 400-mile crude oil pipe line from Plaza Huincal field to Bahia Blanca is planned by Yacimientos Petroliferos Fiscales of Argentina. Alberto Landoni, director of production and pipe lines for YPF, is handling the preliminary plans of the project. He announces that bids will not be called for until some time in 1949.

Ellsworth, Kansas, station

Construction of the new compressor station of Cities Service Gas Company near Ellsworth, Kansas, is making scheduled progress. Engine blocks have been poured, dust scrubber foundations poured, scrubbers set, and footings poured for the house foundation. The well house, garage and office building have been completed except for some minor inside details. Two 170-hp compressor units will be installed.

Gas storage reservoir

Texas Gas Transmission Corporation announces that it will construct a natural gas storage reservoir for the City of Memphis. The storage facilities will consist of 63 miles of 26-in. pipe line, extending from Lula, Mississippi, to Memphis. Its capacity will be 67,000,000 cu ft of gas, the company said. At its northern end the pipe line will tie into the City of Memphis gas distribution system so that gas may be delivered from storage during peak cold weather periods this winter.

Contracts for construction of the pipe line have been let to two Texas firms. The N. A. Saigh Company, San Antonio, will lay the southern half of the line; the J. R. Horrigan Construction Company of Houston will build the northern section.

In addition to laying the pipe line, Texas Gas stated it would make changes in its Lula compressor station to permit filling the reservoir during warm periods.

The company has received an emergency certificate from the Federal Power Commission authorizing the construction.

Texas Gas also has before the FPC an application to construct an 840-mile, 26-in. pipe line from Texas to Ohio to enlarge its existing system. On approval of this application, the 63-mile pipe line will form an integral part of the new pipe line.

Take-up and reconditioning

The Texas Pipe Line Company has awarded a contract to Latex Construction Company of Houston to take up and recondition approximately 140 miles of pipe line of varying diameters between Humble pump station and Port Arthur, it is announced by R. B. McLaughlin, president of the pipe line company.

One of the pipe lines is 10¾ in. in diam and extends from Humble to Port Arthur. Four other lines, consisting of pipe 6⅝ in. and 8⅝ in. in diam, run from Humble to Stilson, Liberty County.

The reconditioned pipe has been assigned and will be used on other pipe line projects.

Oil line contract let

A contract has been awarded by The Texas Pipe Line Company to Carl H. Dunn, Fort Worth contractor, to construct 21.5 miles of 10¾-in. pipe line from Wilson Ranch station, Archer County, to Wichita Falls station, Texas, it was announced by R. B. McLaughlin, president of the pipe line company.

Texas-Chicago line proposed

Gulfcoast Northern Gas Company, Tulsa, Oklahoma, is seeking Federal Power Commission authorization to construct and operate approximately 1184 miles of transmission line, with appurtenant equipment, to transport natural gas from the La Gloria-Seeligson gas fields in Texas, through Missouri, and on to a connection with the facilities of Natural Gas Pipeline Company of America in Henry County, Illinois. Cost of the project has been estimated at $119,000,000.

The 1184-mile transmission line would be of 26-in. OD pipe, the company said. In addition, construction was proposed of a total of 83 miles of

PROJECTS

lateral line to Feazel and Logansport gas fields, 12 new compressor stations with a combined capacity of 115,200 hp, measuring stations, and other equipment.

Would add compressor units

Atlantic Seaboard Corporation has applied to the Federal Power Commission for authorization to install and operate two 800-hp gas engine compressor units at a new station near Hanover, West Virginia. Cost of the units and appurtenant equipment has been estimated at $480,000.

The new facilities would be used in conjunction with the company's present facilities to transport increased quantities of natural gas to supply its present markets, including part of the increased requirements of Washington Gas Light Company.

Following completion of the facilities, deliveries of an additional 8,000,000 cu ft of natural gas can be made daily at the Rockville, Maryland, measuring station, at which point natural gas is sold to Washington Gas Light Company, the company added.

Seek additional facilities

Three members of the Pittsburgh Group of the Columbia Gas System, Inc., have filed a joint application with the Federal Power Commission for authorization to construct and purchase additional facilities for the purpose of receiving additional quantities of natural gas for redelivery to present customers and to existing storage fields. The three companies are The Manufacturers Light and Heat Company, Home Gas Company, and Natural Gas Company of West Virginia. Cost of the proposed project has been estimated at $963,863 with some allowance for salvage from facilities to be retired from use.

Included in the facilities proposed to be constructed by The Manufacturers Light and Heat Company are about 10½ miles of 12-in. pipe line from a point on an existing line near Canonsburg, Pennsylvania, to the vicinity of Pittsburgh; about five miles of 6-in. line extending from near Steubenville to Winterville, Ohio; installation of two 500-psi compressor cylinders to replace an existing 100-psi cylinder at Waynesburg compressor station in Greene County, Pennsylvania; and a 334-hp compressor station near Cameron, West Virginia. In addition, the company plans to retire three 125-hp rotary-type compressors at Waynesburg, Turkey Hollow, and Monessen compressor stations in Pennsylvania; and about 17 miles of 8-in. transmission line between a compressor station in Wetzel County, West Virginia, and a point in Greene County, Pennsylvania.

Home Gas Company proposes to purchase from its affiliate, The Keystone Gas Company, Inc., the Dundee compressor stations and storage field in Yates and Schuyler counties, New York, and to install a 300-hp compressor station in Greenwood Town, New York.

Natural Gas Company of West Virginia would construct about five miles of 8-in. gas line from Brinker compressor station to the vicinity of Salem Township in Ohio.

Gas line completed

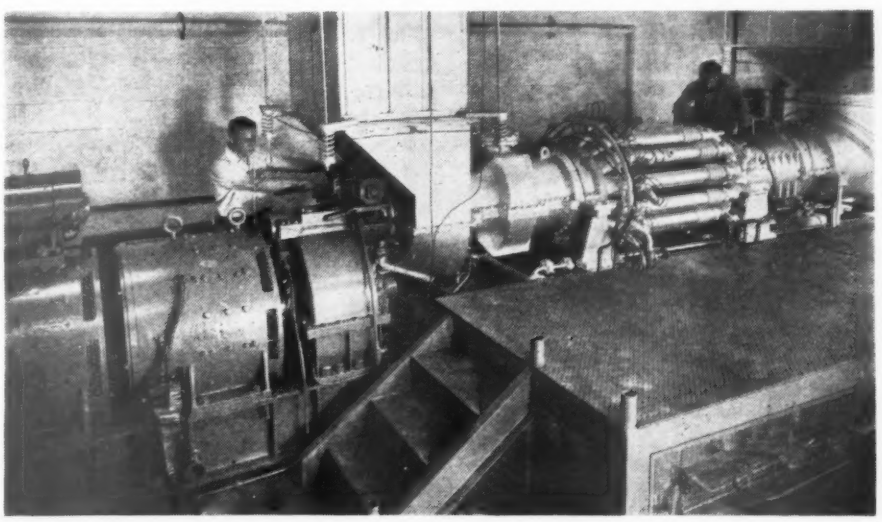
A 53.86-mile, 24-in. pipe line has just been completed for the Natural Gas Pipeline Company of America by Continental Construction Company. This line was laid eastward from the company's No. 10 compressor station, which is near Geneseo, Illinois. It is parallel to and for the most part on the same right-of-way as the original line laid in 1931. With 46 miles laid to September 21 and progress at the rate of 2800 ft per calendar day, it was anticipated that the project would be completed about October 10.

To install turbine on natural gas line

The same 2000-hp combustion gas turbine that recently completed a test operation in excess of 1000 hr at the Westinghouse Turbine Division, Essington, Pennsylvania, is being shipped to the Mississippi River Fuel Corporation where it will go into service driving a compressor on the natural gas line between Monroe, Louisiana, and St. Louis, Missouri.

Arrangements have been made through the cooperation of Westinghouse, Mississippi River Fuel, and Ingersoll Rand for a six months' trial beginning early in 1949. The gas turbine will drive an Ingersoll Rand centrifugal compressor at 8750 rpm. It will be modified to suit the application with a bed-plate for mounting all components including the compressor.

This is expected to be the first application of a mechanical drive combustion gas turbine in industry in this country. According to Westinghouse officials, it reduces maximum power per pound of weight, requires only a simple, inexpensive concrete mat foundation, and can be trucked into remote undeveloped regions. It can be set up and made ready to operate in a few hours. It needs no water and very little lubricating oil. Maintenance problems are minimized because of the few moving parts, it is pointed out.



Pipe Line Marine Transportation Personals

C. J. White, assistant chief engineer of The Texas Pipe Line Company at Houston, Texas, has been transferred to Midland, Texas, as acting division manager of the new Jal-Cushing line of the Basin Pipe Line System. **R. B. Trow,** civil engineer, has been promoted to acting assistant chief engineer of The Texas Pipe Line Company.

Hal Price, president of H. C. Price Company, contractors of Bartlesville, Oklahoma, is now rapidly convalescing from his recent illness. This will be welcome news to his many friends, who are looking forward to seeing him at the API convention in Chicago next month.

E. F. "Ernie" Semrad, for a number of years gas engineer for Cities Service Gas Company in the Oklahoma City office and formerly with the valuation department, has resigned to accept employment with Ford, Bacon and Davis, Inc. He has his headquarters in Kansas City, Missouri.

Lester L. Baker, 69, died recently in a Caney, Kansas, hospital from injuries received in an automobile accident near Dewey, Oklahoma. Baker had been continuously employed by Cities Service Gas Company for a period of 37 years and at the time of his death was machine shop foreman at Caney. He joined the company in April, 1911, as superintendent of the compressor station at Caney.

R. N. Montgomery, vice president and general superintendent of The Illinois Pipe Line Company of Texas, has retired after 39 years' service with the company and its affiliates. He is succeeded by **Samuel A. Click,** formerly superintendent for the company in the East Texas field.

Montgomery has had wide experience in the oil industry, having started work in the oil fields of Indiana at the age of 16. He was first employed by The Ohio Oil Company as a pumper in the Illinois field in 1909. At the time of the early development of crude oil production in Wyoming in 1917, he was transferred to Big Muddy, Wyoming, as a district field gauger with The Illinois Pipe Line Company. He successively became district foreman at Big Muddy, division superintendent at Casper, Wyoming, and superintendent at Shelby, Montana.

In 1927, when The Illinois Pipe Line Company constructed a gathering system in the Yates field of West Texas and a trunk line to Del Rio and Lytle, Texas, Montgomery was transferred to Del Rio as superintendent of operations, and in 1937 became gen-

R. N. Montgomery

S. A. Click

eral superintendent of all the company's Texas operations, with headquarters in Houston.

Since 1942, Montgomery has been a vice president, assistant treasurer, and director of The Illinois Pipe Line Company of Texas, which company took over the Texas operations formerly conducted by The Illinois Pipe Line Company, and also has been general superintendent since the company's formation.

Click, who succeeds Montgomery, has been associated with The Ohio Oil Company, The Illinois Pipe Line Company, and The Illinois Pipe Line Company of Texas since 1922 in the Louisiana and East Texas areas. Click's headquarters will be in Houston.

J. L. Cahill, Tulsa, Oklahoma, designer of precision instruments and inventor of a hardening process for stainless steel, has been appointed chief engineer of Continental Pipe Line Company. Cahill's engineering carer has covered a broad field of research, designing, and construction. During the war Cahill assisted in launching the Seabee program by designing portable equipment for overseas shops and in designing power tools for use under battle conditions. He helped to develop the 20-mm. anti-aircraft cannon for the Bureau of Ordnance and did special work for the Bureau of Ships. Recently he served as design and sales engineer for the Diesel Power Company, Tulsa.

J. L. Cahill

James B. Gary, Jr., has been appointed supervisor of construction for Great Lakes Pipe Line Company, it is announced by Harry Moreland, president.

Since his graduation from Kansas City schools, Gary has been engaged in various phases of construction work. Immediately after his discharge from the Army in 1945 he was employed by D. C. Bass and Sons Construction Company of Enid, Oklahoma, on construction of Great Lakes pump stations and terminals on the pipe line from Kansas City to Grand Forks, North Dakota. Following this he was a partner-owner of a construction firm in Kansas City.

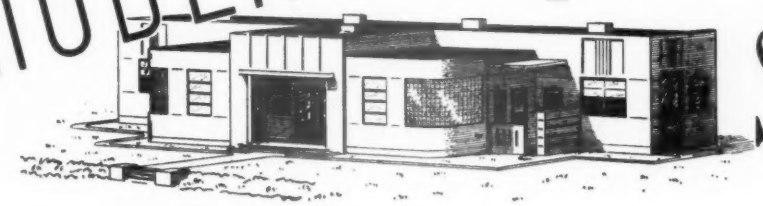
C. L. Bushell, secretary of the Ajax Pipe Line Corporation, has resigned, it was announced by Ajax Vice President J. R. Doles at a luncheon in Tulsa, Oklahoma, September 29. Given in Bushnell's honor, the luncheon was attended by approximately 30 of his close friends and associates in the Ajax and Interstate Oil Pipe Line Company organizations.

Bushnell's retirement climaxes a career of almost 45 years devoted exclusively to transportation. Of this period, most of the first 23 years were spent in the railroad field. In 1927, he was employed in the claims and right-of-way department of the Oklahoma Pipe Line Company, headquarters of which were at that time in Muskogee. Oklahoma Pipe Line Company became Interstate Oil Pipe Line Company in December, 1944.

In June, 1930, the newly formed Ajax Pipe Line Corporation began building a crude oil pipe line from Glenn Pool, Oklahoma, to Wood River, Illinois. Bushnell transferred to the Ajax company's headquarters in Springfield, Missouri, and began acquiring rights-of-way for the new line.

After the Ajax line was completed, in January, 1931, Bushnell was elected secretary of the corporation.

MODERN Pipe Line STATIONS



NEW STATIONS IN UTILITY LINE SERVICE

SUNRAY OIL CORPORATION has recently placed in operation a plant utility pipe line system to connect its refineries at Allen and Duncan, Oklahoma. The system consists of 96 miles of 6-in. line and three pumping stations, the latter at Allen, Wynnewood, and Duncan. Flow in the line is reversable, thus, as requirements dictate, the line is used interchangeably to pump gas oil charge stock from Allen to the "cat" cracker at Duncan, or distillate and blending stock from Duncan to Allen. Line capacity for gas oil is approximately 10,000 bbl a day and for the lighter products, distillate and blending stock, 17,000 bbl a day, at pump discharge pressure of 1100 psi.

All products are batched through the line, samples being taken to determine change in material being pumped. Manifolds are so arranged that the stream can be reversed with minimum contamination. The manifolds have a swing line arrangement for pumping to or receiving from the tanks.

The three stations are of permanent type and contain indentical pumping units. The only differences in the stations are in the matter of storage capacity and construction of the manifolds, which points will be discussed later. At each station there is one 12½-in. by 13-in., 6-cylinder, dual-fuel diesel engine that develops 540 hp at 600 rpm. The engine is connected through a speed increaser to an 8-stage, 3600-rpm centrifugal pump. Between the engine and speed increaser are two flexible couplings. At the firewall the extension shaft on the engine is packed off with an asbestos seal ring. Engine speed is controlled by the suction and discharge pressures of the pump by means of an air-actuated controller.

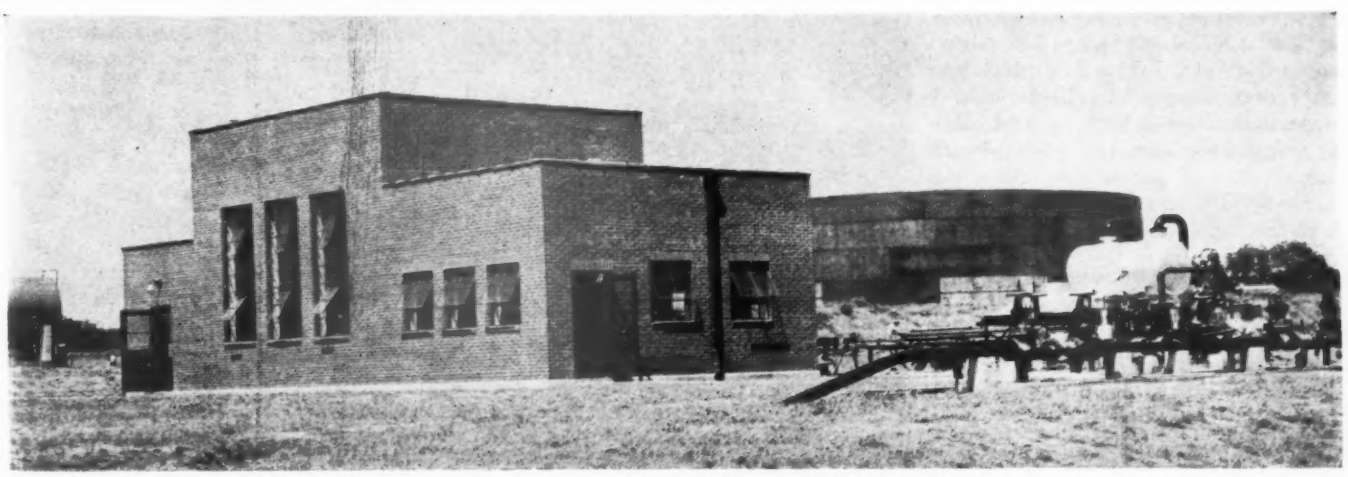
The engine jacket water cooling system is totally enclosed, cooling of the water being accomplished by heat exchange with the product being pumped. A water blending valve regulates the temperature of the jacket water.

Starting air is supplied by a 20-cu ft air compressor driven by a 5-hp motor.

At Duncan there are six 80,000-bbl storage tanks for pipe line storage service, and at Allen and Wynnewood one 80,000-bbl tank each. From refinery tanks a motor-driven pump is used to boost the product to the suction of the pipe line station pump, which normally is 20 psi. For this service a 30-hp motor drives a 120-ft head centrifulgal pump having a rated capacity of 750 gpm. All tanks are equipped with electric gauges, and thus the volume of product in each tank can be ascertained by the operator reading from a panel in the office.

Mention was made earlier in this article that some differences existed in the manifolds. End stations, those at Duncan and Allen, were of necessity designed to filter the stream coming in from the line as well as from the tanks. Also, design at these stations had to be such as to permit the running of scrapers from either direction, inasmuch as they are used as batching

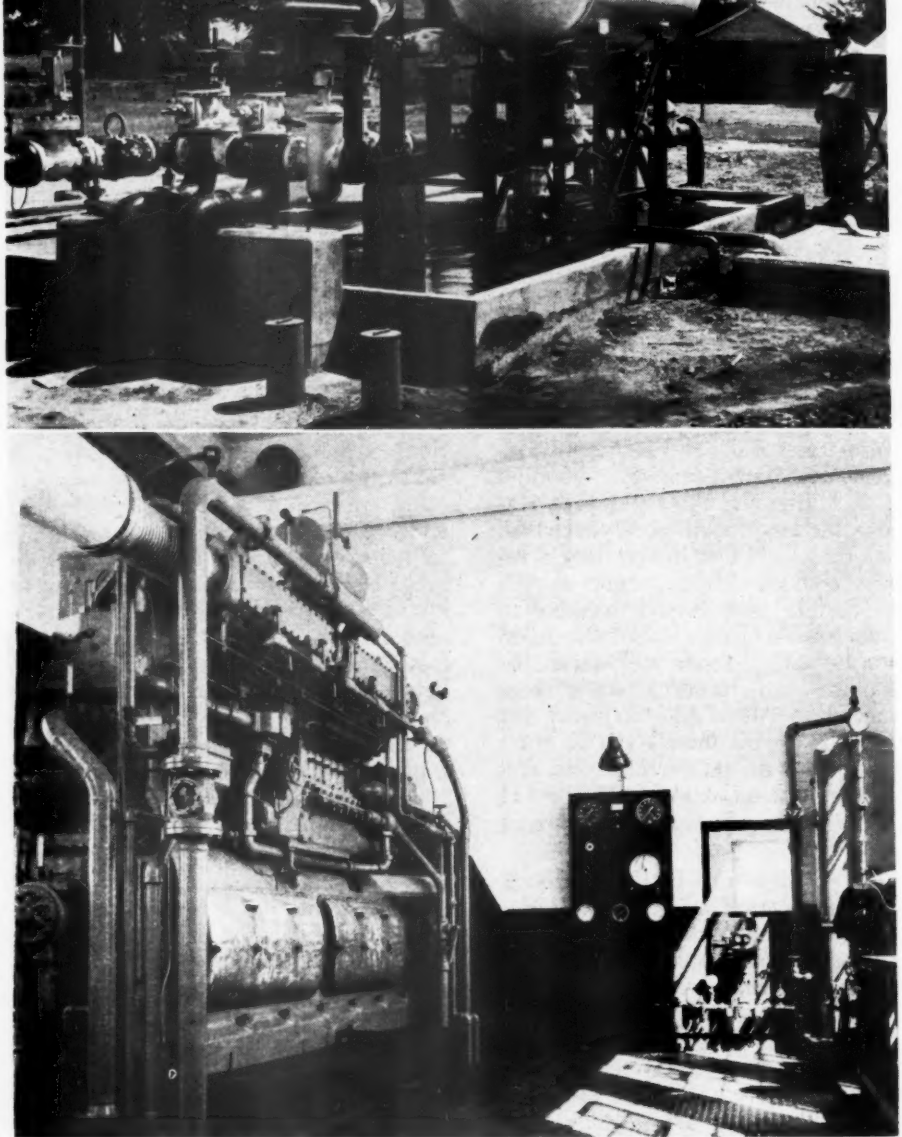
Outside view of Wynnewood, Oklahoma, pumping station of Sunray Oil Corporation. This shows the brick-type building construction employed at this station as well as those at Allen and Duncan stations.

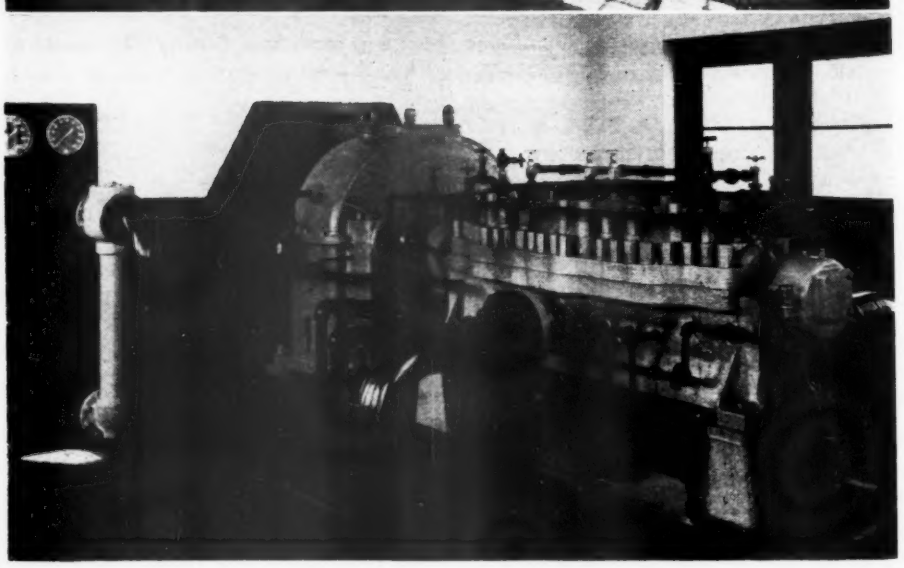


Top — Manifold at Allen, Oklahoma, station. Manifolds at all three stations are so arranged that the stream can be reversed with minimum contamination.

Center — Engine at Duncan station looking toward firewall, which is between engine and pump room. This is a 12½-in. by 13-in., 6-cylinder, dual-fuel diesel engine that develops 540 hp at 600 rpm. Engines at other stations are the same.

Bottom — Interior of pump room at Duncan. All pumps are 8-stage, 3600-rpm centrifugal units connected through a speed increaser to the engines.





plugs when it is necessary to separate products that vary considerably in gravity and viscosity. At the intermediate station at Wynnewood, it was thought expedient to install a dual check valve arrangement whereby the station could be bypassed from either direction should occasion demand. The station and storage at Wynnewood serves a purpose in addition to that of pumping—the facilities making it possible for Sunray to purchase charging stock from other refineries in the area and hold the material either there, at Duncan, or at Allen until needed at the Duncan refinery.

An air cooler has been installed at each station to supplement the heat exchange equipment when heavy gas oil is being pumped. The air cooler is of the induced draft horizontal type, a 5-hp motor driving the fan.

Station buildings are of brick construction with polished red concrete floors. Housed in the building is the office as well as the engine and pump rooms. The overall measurement of each building, exclusive of the office, is 24 ft wide by 48 ft long. The engine room is 26 ft 1 in. by 24 ft wide and the pump room is 18 ft long by 24 ft wide. The office is 11 ft by 12 ft. The buildings have acoustical ceilings with baked enamel finish to reduce the noise level. Engine and pump room both are equipped with an overhead crane for handling heavy machinery. Jacket water and lube oil coolers are installed in trenches inside the building beneath the floor. A small gas-fired steam heating unit using natural gas as fuel serves to heat the building.

Auxiliary equipment is operated by purchased electric power. * * *

Pipe line contractors

Continued from Page 344

Line Company to lay 114 miles of 26-in. in western Kansas. Work is expected to begin about October 25.

For Michigan-Wisconsin Pipe Line Company, a crossing of the Cimarron River is being made near Liberal, Kansas. This job is about completed.

▸ **N. A. Saigh Company,** San Antonio, Texas, is at present constructing three river lines for Tennessee Gas Transmission Company, one 14-in. and two 12-in. lines. These are across the Mississippi River at Greenville, Mississippi, south of the bridge. Land lines of 26-in. pipe are being laid on each side of the river to existing headers.

The company also is laying 33 miles of 26-in. pipe for Tennessee Gas from Lula to Banks, Mississippi. Work has begun and completion date is set for November 15.

In preparation for work in Tennessee and Kentucky, several hundred miles of 26-in. pipe is being unloaded and stacked on land adjacent to railroad points. This also is for Tennessee Gas Transmission Company.

The company has been awarded contract to construct the following lines for East Tennessee Natural Gas Company, Chattanooga, when pipe is available:

186 miles of 16-in. from Centerville to Chattanooga,
112 miles of 12-in. from Chattanooga to Knoxville,
100 miles of miscellaneous lines ranging from 4 in. to 8 in.

For East Tennessee Natural the company probably will lay the Atomic Energy Commission line from Nashville to Oak Ridge, it is announced. This would be 164 miles of 22-in.

▸ **Bill Morrison Construction Company,** Tulsa, Oklahoma, is doing considerable work at the present time for the Sinclair Refining Company. Principal work is 76.5 miles in the vicinity of Carrollton and Shannondale, Missouri, 73 miles at Kansas City, 69.98 miles near Marceline and La Plata, Missouri, 71.28 miles near La Plata and Gorin, Missouri, conversion of a line between Shawnee, Oklahoma, and Kansas City, and 37.74 miles of reconditioning, road and river crossings at Brunswick, Missouri. All jobs are 8-in. lines.

▸ **Anderson Bros. Corporation,** Houston, Texas, is laying for McCarthy Oil and Gas Company a total of 100 miles of 12-in., 14-in., 16-in., and 20-in. pipe lines from Jackson Pasture to Orange, Texas. Anderson Brothers also have under construction 30 miles of 24-in. in Kentucky for Tennessee Gas Transmission Company. Some work is also being done for Ohio Fuel Gas Company.

▸ **Eastern Construction Company,** Dallas, Texas, presently is engaged in construction of a 70-mile, 20-in. gas line from Opelika to Dallas, Texas, for the Lone Star Gas Company. The right-of-way has been completed, but due to shortage of pipe 11,000 ft had been laid to October 4.

▸ **Associated Contractors and Engineers,** Houston, Texas, are laying 127 miles of 6-in. line for Socony-Vacuum Oil Company, Inc., from Portland to Bangor, Maine.

The company also is laying 20 miles of 8-in. for The Texas Company, Gas Division, from Golden Meadows to Bay St. Denis in the La Fitte, Louisiana, area.

▸ **Stolte Inc.,** Oakland, and **Pacific Pipeline & Engineers,** Los Angeles, California, as a joint venture, are laying 22 miles of 30-in. gas main in San Mateo County for Pacific Gas and Electric Company. Carl Biddle is the project manager. Stolte Inc. also is laying 8500 ft of 8-in. from Crockett to Oleum, California. This job began September 20. Hank Wilson is foreman.

Separate trading department

Continental Oil Company's oil trading section of the pipe line division has been made a separate crude oil trading department with T. A. van Griethuysen as manager, it is announced by L. F. McCollum, president.

Van Griethuysen, formerly assistant manager of the pipe line division, in charge of oil trading, is completing his twentieth year with Continental Oil Company. Born at Perkins, Oklahoma, he received his early education there and later was graduated from the University of Oklahoma.

Beginning with Continental in 1929, he held positions in the general accounting, personnel, and real estate divisions and in 1935 was transferred to the production and drilling department. He advanced to superintendent of oil trading in 1939 and became assistant manager of the pipe line department, in charge of oil trading, in 1943.

Gas transmission fellowship

Establishment of a graduate fellowship for study and research in the field of natural gas transmission by the Tennessee Gas Transmission Company, Houston, Texas, has been announced by F. C. Bolton, president, and Harold Vance, head, Department of Petroleum Engineering, Texas A. & M. College, College Station.

Candidates for the fellowship may be graduates of any accredited college or university. Selection of the fellowship recipient will be made by Mr. Vance in consultation with officials of the Tennessee Gas.

College officials give high praise to the establishment of the fellowship in view of the rapidly increasing field of natural gas transmission and its importance to the Southwest.

W. W. Hay passes away

W. W. "Bill" Hay, manager of pipe lines for Union Oil Company of California died unexpectedly September 23, at his home in Fullerton, California, within a week of his 60th birthday. Hay, long prominent in pipe line affairs in California, was born in Great Britain, lived his boyhood in Coleraine, Ireland, and was educated at Coleraine Academy. He went to California in 1915 and was immediately employed by Union Oil Company as a pipe line dispatcher at San Luis Obispo. He became superintendent of the Los Angeles pipe line in 1923.

W. W. "Bill" Hay

Appointed manager of pipe lines by Union in 1936, he became manager of pipe lines and communications in 1940.

Oil Progress Day observed

Open house at 10 gaily decorated pipe line pumping stations where the public was given refreshments and told how oil products are transported featured "Oil Progress Day" in the Southeast on October 14.

Special "Oil Progress Day" meetings were held in nearly a score of communities in North Carolina, and in Georgia oil men spoke before more than 50 civic and luncheon clubs. There were special meetings at Atlanta, Columbus, Augusta, Macon, and Savannah.

In Florida, there were 34 speaking dates with special meetings in Tampa, Pensacola, Orlando, and Tallahassee. A new terminal was opened on "Oil Progress Day" by an oil company at Miami.

Hearing on rate increase

The Federal Power Commission has suspended pending hearing and decision, supplemental rate schedules proposed by Interstate Natural Gas Company, Inc., to increase rates and charges for natural gas sold to Mississippi River Fuel Corporation, Texas Gas Transmission Corporation, and Southern Natural Gas Company.

ADVERTISERS *index*

A

Amercoat Division, American Pipe and Construction Co. 24
American Car & Foundry Co. 33
American Chain & Cable Co., Inc. 59
American Cyanamid Co. 163
American Manufacturing Co. of Texas 2
American Recording Chart Co. 76
American Roller Bearing Co. 83
Armstrong Bros. Tool Co. 117
Arabian American Oil Company 118
Axelson Manufacturing Co. Inside Back Cover

B

B & W, Inc. 258
Baash-Ross Tool Co. 135
Babcock & Wilcox Tube Co. 315
Baker Oil Tools, Inc. 55
Baroid Sales Division, National Lead Co. 157
Baroid Sales Division, Specialty Dept., National Lead Company 12
Barrett Division, The 329
Bethlehem Steel Corporation 183
Black, Sivalls & Bryson, Inc. 165-166
Bowen, S. R., Company 169
Brewster Company, Inc., The 189
Brown & Root, Inc. 7
Bucyrus-Erie Company 96
Burgess-Manning Company 64
Byron Jackson Company 177

C

Cameron Iron Works Front Cover, 202
Campbell, J. A., Co. 117
Caterpillar Tractor Company 141
Cavins Company 239
Chapman Valve Manufacturing Co. 18
Chicago Bridge & Iron Co. Inside Front Cover
Chrysler Corporation, Industrial Engine Division 21
Cities Service Company 22
Clark Bros. Co., Inc. 74-75
Classified Advertisements 118
Cleveland Trencher Company 328
Colorado Fuel & Iron Corp., Wickwire Spencer Steel Division 113
Continental Supply Company 250-251, 199-200
C. Lee Cook Mfg. Co. 320
Cook Electric Company 287
Cooper, Fred E., Inc. 185
Cooper-Bessemer Corp. 47
Core Laboratories, Inc. 191
Crane Co. 27
Cummins Engine Company 203
Curtin, W. H., Co. 304

D

Darling Valve & Manufacturing Co. 110
Dean Bros. Pumps, Inc. 309
Detroit Diesel Engine Division, General Motors Corp. 249
Dixie Chemical Company 241
Dowell Incorporated 17
Dow Chemical Company 88
Dresser Industries, Inc. 20, 74-75, 90, 143, 331
Dresser Mfg. Division 331
DuPont, E. I. de Nemours & Co. 153
Dura metallic Corporation 87

E

Emsco Derrick & Equipment Co. 199-200
Enardo Manufacturing Co. 68
Ensign Carburetor Company 57

F

Falstrom Company 118, 304
Fawick Airflex Co., Inc. 245
First National Bank of Dallas 85
Fluor Corporation, Ltd. 299
Flint Steel Corporation 307
Ford Motor Company 161
Foxboro Company, The 104

G

Gardner-Denver Co. 32
Gaso Pump & Burner Manufacturing Co. 317
Gearench Manufacturing Co. 114
General American Transportation Corp., Plate & Welding Division 19
General American Transportation Corp., Process Equipment Division 266
General American Transportation Corp., Wiggins Seal Division 25
General Electric Company 145
General Paint Corporation 345
Geolograph Company 168
Graver Tank & Mfg. Co., Inc. 77
Gray Tool Company 225
Grip-Tite Mfg. Co. 344
Griscom-Russell Co. 102
Grove Regulator Company 311
Guiberson Corporation 223, 254

H

Haering, D. W., & Co. 81
Halliburton Oil Well Cementing Co. Back Cover
Hammond Iron Works 94
Harper & Bros. 259
Harrisburg Steel Corporation 82
Helicoid Gage Division, American Chain & Cable Co., Inc. 59
Hercules Tool Co. 256
Hill, Hubbell & Co. Div., General Paint Corp. 345
Hilliard Corporation, The 109
Hobbs Manufacturing Co. 168
Horrigan, J. R., Co. 349
Hughes Tool Company 148
Humble Oil Company 26
Hunt Tool Company 219
Hyatt Bearings Division, General Motors Corp. 65

I

Ingersoll-Rand Co. 326-327
International Harvester Company 28
International Rolling Mill Products Corp. 61-62

J

J & P Machine Co. 162
Jensen Bros. Mfg. Co. 232
Johnston, M. O., Oil Field Service Corp. 193
Jones & Laughlin Steel Corp. 119
Jones, S. M., Co. 175

K

Kellogg, M. W., Co. 273
Kobe, Inc. 143

L

Ladish Company 147
Lane-Wells Company 54, 181, 215, 263
Larkin Packer Company 197
Leland Equipment Co. 240
Line Scale Co., Inc. 258
Link-Belt Co. 187
Lucey Export Corporation 236
Lufkin Foundry & Machine Co. 130
Lunkenheimer Co., The 58

M

McCullough Tool Company 227
McNamar Boiler & Tank Co. 107
Magnet Cove Barium Corp. 257
Maintenance Engineering Corp. 279
Marine Products Co. 60
Mark, Clayton & Company 14
Marley Company, Inc., The 92
Marlow Pumps 171
Marmon-Herrington Co. 108
Marsh, Jas. P., Co. 29
Mercoid Corporation 106
Mid-Continent Supply Co. 137
Mines Equipment Company 253
Mission Manufacturing Co. 212-213
Moore, Lee C., Corp. 195
Murray Rubber Company 229

N

Natasco Company, The 334
National Airoil Burner Co., Inc. 111
National Supply Company 50, 51, 52
National Technical Laboratories 303
Naylor Pipe Co. 116
Nordstrom Valve Division 291-292
Norris, W. C., Manufacturer, Inc. 1
Norvell-Wilder Supply Company 247

O

Oakite Products, Inc. 64
Ohio Injector Co., Inc. 281
Oil Center Tool Company 122
Oil Well Supply Co. 205
Onan, D. W., & Sons, Inc. 109
Otis Pressure Control, Inc. 173

P

Pacific Pumps, Inc. 20
Paddock Engineering Co., of Texas 304
Page Oil Tools, Inc. 234
Patterson-Ballagh Division of Byron Jackson Co. 210, 259
Peabody Engineering Corp. 283
Peerless Pump Division, Food Machinery and Chemical Corporation 115
Penberthy Injector Co. 9
Petro-Chem Development Co. 268
Petroleum Electric Power Association 34
Petroleum Engineer, The 306
Petroleum Rectifying Company 289
Pittsburgh Equitable Meter Division 295
Pritchard, J. F. & Co. 297

R

Reed Roller Bit Company 38
Refinery Supply Co. 313
Republic Flow Meters Co. 312
Republic Steel Corp. 151, 159
Republic Supply Co. 132-133
Ric-wiL Co. 285
Ridge Tool Co. 69, 85
Rockford Clutch Division 112

S

SKF Industries, Inc. 73
Sapulpa Tank & Mfg. Co. 67
Schlumberger Surenco 124
Security Engineering Co., Inc. 209
Shaffer Tool Works 138
Smith, A. O., Corp. 243
Spang & Co. 186
Spang-Chalfant Division, The National Supply Co. 49
Sperry Sun Well Surveying Company 233
Squier, John P., Co. 305
Staedtler, J. S., Inc. 115
Standard Oil Company of California 80
Sun Shipbuilding & Dry Dock Co. 308
Sunshine Iron Works 259

T

Taylor Forge & Pipe Works 31
Technical Oil Tool Corp., Ltd. 179
Texas Company, The 86
Thermoid Company 15
Thompson Tool Company 220
Thornhill-Craver Co. 261
Toledo Pipe Threading Machine Co. 98
Torrington Co. 100
Tretolite Company 221
Tube-Turns, Inc. 79-80
Twin Disc Clutch Company 155

U

Unit Rig & Equipment Co. 121
United States Steel Corp. 205
United Supply & Manufacturing Co. 231
Universal Controls Corp. 306
Universal Oil Products Co. 5

V

Visco Products Co., Inc. 70
Vogt, Henry, Machine Co. 301

W

W-K-M Co., Inc. 217
Watson-Stillman Co. 238
Wedge Protectors, Inc. 117
Well Equipment Manufacturing Corp. 230
Western Suply Cop. 35
White, David, Co. 66
Whitney Chain & Manufacturing Co. 255
Wickwire Spencer Steel Division, The Colorado Fuel & Iron Corp. 113
Williams Bros. 318
Williamson, T. D., Inc. 342
Wilson, K. R. 37
Wilson Manufacturing Co., Inc. 206-207
Wilson Supply Co. 235
Wisconsin Motor Corp. 237
Worthington Pump & Machinery Corp. 338-339

Y

Young Radiator Co. 111
Youngstown Sheet & Tube Co. 23